INSIDE: REAL-TIME CONTROL … MIL-STD-1553 … PACKAGING TRENDS

CompactPCI® Systems

The Magazine for Developers of Industrial, Communication, and Embedded PCI Systems

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DECEMBER 2003
vol. 7 no. 9

2004 BUYER'S GUIDE

AdvancedTCA/Switched Fabric, Packaging, Processor Boards, Ruggedized MIL-SPEC, Datacom, Carrier Boards and Mezzanine/PMC, General Products, Telecom

PICTURED: PORTWELL ROBO-8889VG2 (TOP), ELMA 5U ATCA DEVELOPMENT CHASSIS (LEFT), SYMMETRICOM BC63?CPCI (RIGHT)

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The Magazine for Developers of Industrial, Communication, and Embedded PCI Systems

Volume 7 / Number 9 / December 2003

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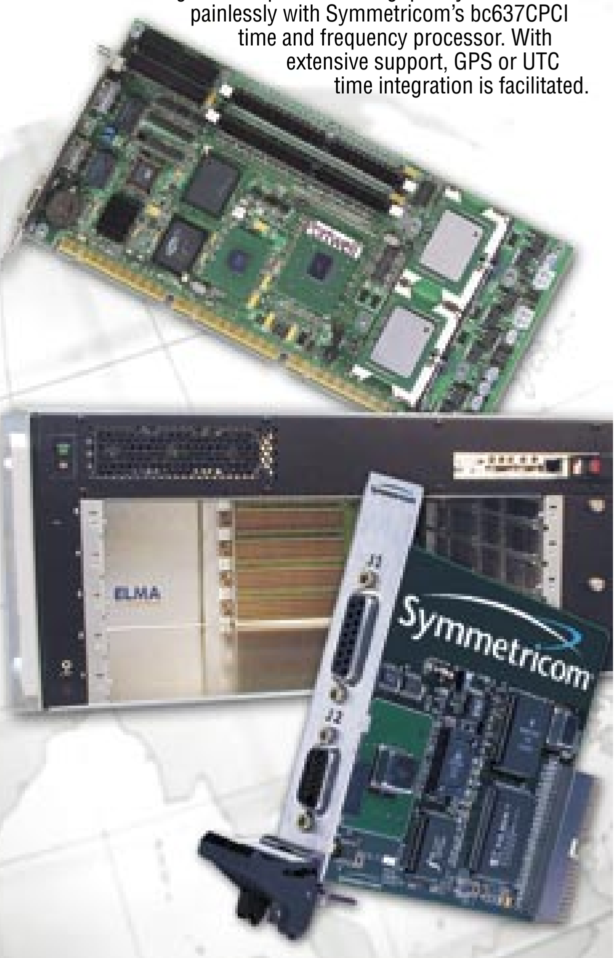
ON THE COVER:

Elma's 5U ATCA Development Chassis is ideal for prototyping and demonstrations.The portable unit plugs into a conventional wall outlet and includes provisions for hot swapping the Elma IPM Sentry Shelf Manager.

American Portwell's Dual Intel® Xeon™ processor PICMG 1.2 SBC, the ROBO-8820VG2 comes with VGA and dual GigE.

Integrate CompactPCI timing quickly and painlessly with Symmetricom's bc637CPCI time and frequency processor. With extensive support, GPS or UTC time integration is facilitated.



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DECEMBER E-LETTER:

DSL Forum, Year in review
By Tom Starr

events

BUS & BOARDS
January 19-20, 2004
Long Beach, CA

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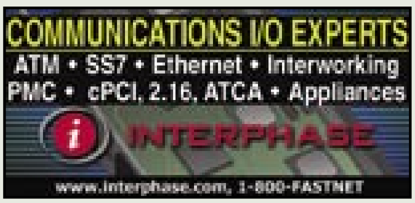

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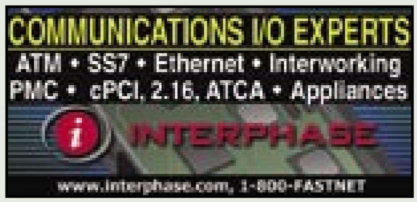

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Choosing the right CompactPCI board for your MIL-STD-1553 applications

By Rich Wade

The telecom market was, and remains to a degree, the initial impetus for the success of CompactPCI. Despite the downturn in the telecom market it continues to be a mainstay in computer telephony, real-time machine control, data acquisition, industrial automation, and commercial and military avionics. CompactPCI is well suited for other applications that require high-speed computing, a robust package design, and long-term manufacturer support as well. It's no wonder that CompactPCI is rapidly becoming an alternative to VME as the preferred interface for many applications.

One of the reasons for this migration is primarily because VME equipment is often more expensive and more likely to become obsolete. In addition to being cost effective over the long haul, CompactPCI's rugged, modular design comes in 3U and 6U sizes, identical to the VME form factor and provides the advantage of the faster, plug-and-play PCI bus. Likewise, CompactPCI and PXI offer a viable alternative to VXI for test and instrumentation applications. This could be the reason that the avionics industry is integrating CompactPCI for both laboratory and flight applications.

Military applications rely heavily on the MIL-STD-1553 databus for communication between the pieces of equipment that make up an avionics system. Although the specific requirements needed for a MIL-STD-1553 interface vary by application, there are a number of key items to take into consideration when determining an optimal CompactPCI board for a military avionics databus application. These include:

- Channel density: Since aircraft avionics normally have multiple databuses, it's desirable to have multiple channels on a single board. This reduces board count, overall system cost, and power requirements.
- Memory: Avionics designers prefer interfaces that include more memory per channel providing greater flexibility for the application software, while increasing data buffering capabilities.
- Single and multiple function options: Single function (remote terminal ONLY, bus controller ONLY, or bus monitor ONLY) interfaces are satisfactory for simple applications, but the more complex the application or system simulation, the more there is a need for a multiple-function interface. Ideally, multiple function interfaces should not only monitor simultaneously, they also need to be able to simulate all remote terminals and the bus controller. Additionally, the board's application programming interface (API) should allow operation with either single or multiple function interfaces from the same software. This allows development and testing using multiple function interfaces for system integration, while at the same time offering the advantage of using lower cost single function interfaces in the final system, eliminating the need to change the software.

Also, in determining the optimal MIL-STD-1553 CompactPCI board, engineers should consider the following Bus Controller, remote terminal, and Bus Monitor features.

Bus Controller features

Look for the following in Bus Controller applications:

- Frame timer: The interface should have an internal timer to manage message frame times relieving the controlling software from performing this task on timing.
- Conditional branching: Based on user-defined conditions, the Bus Controller should have the capability to branch to different message lists. This should be done on the board rather than requiring the controlling software to detect the condition and manually change the message list.
- Aperiodic messages: The Bus Controller should be able to inject aperiodic messages into the frame while running, allowing easy insertion of one time events on the bus.

Remote terminal features

Look for the following in remote terminal applications:

- Message legalization: The remote terminal should support message legalization down to the word-count level. Many MIL-STD-1553 interfaces only support legalization to the sub-address level, while others do not support it at all. The benefit of message legalization is that it allows the device to block out unimplemented sub-addresses and word counts.
- Multiple data buffers per sub-address: The remote terminal should define as many message buffers per sub-address as desired (limited by available memory). The interface should also provide the ability to set interrupts on specific message buffers that will significantly reduce the demands on the controlling software for servicing the message buffers.

Bus Monitor features

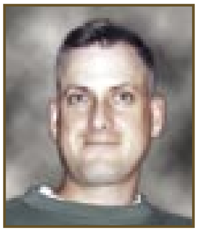
Look for the following in Bus Monitor applications:

- Sequential monitor: The Bus Monitor should provide the option to record messages sequentially as they are seen on the bus, including error information. This should include options for filtering in order to capture only the desired messages. The sequential monitor should also have the ability to define trigger events to start and stop monitoring.
- RT Monitor: The Bus Monitor should provide an option to record messages by remote terminal and sub-address.

This is useful for current value monitoring where one is interested in the most current data for a specific remote terminal and sub-address.

- Message Time: All messages that the Bus Monitor captures should record the time that the message occurred. High resolution (1 microsecond LSB) is desired for accurate time correlation of data.

Condor Engineering provides CompactPCI interfaces for a variety of avionics databus protocols, including MIL-STD-1553, the new emerging MMSI protocol, ARINC-429, and other ARINC protocols (573, 575, 717, and more). The cPCI-1553 MIL-STD-1553 interface board from Condor Engineering is suited for military avionics applications. This product offers options for multiple channels, 1 Mbyte of memory per channel, single and multiple function configurations with common software, and includes the BC, RT, and BM features discussed previously.



Rich Wade *joined Condor Engineering in 2001 and is one of the developers of the CORE-1553 and CORE-MMSI products. He works closely with Condor Engineering customers for system integration and application development. Rich has avionics engineering and management experience since 1995. He has a BSEE from New Mexico State University and is a Captain in the US Army.*

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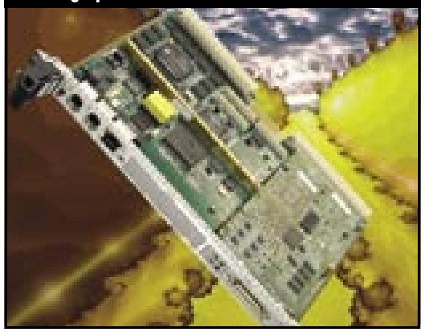
RUGGED PRODUCTS

Data Device Corp. BU-65566

Primagraphics Radar Video Distribution Server



Company Name	Web Site	ARINC	Avionics	MIL-Spec	MIL-STD-1397	MIL-STD-1553	Radar/Sonar	STANAG 3910	Telemetry
Aborn	www.aborn.com.tw			✓					
Actis	www.actis-computer.com					✓			
Adas	www.adas.fr	✓				✓			
AIM USA	www.aim-online.com	✓	✓			✓		✓	
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Alphi Technology	www.alphitech.com					✓			
AMREL	www.amrel.com			✓					
Andor Design	www.andordesign.com					✓			
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Carlo Gavazzi	www.carlogavazzi.com					✓			
Condor Engineering	www.condoreng.com	✓				✓			
Creative Electronic Systems	www.ces.ch					✓			
Data Device	www.ddc-web.com					✓			
Dy 4	www.dy4.com			✓		✓			
Excalibur Systems	www.mil-1553.com	✓				✓			
GE Fanuc Automation	www.gefanuc.com/embedded			✓					
General Dynamics	www.gdds.com/space								✓
General Standards	www.generalstandards.com								✓
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Serial Mesh: PICMG 2.20

Gig E: VITA 31.1

CPSB: PICMG 2.16

StarFabric: PICMG 2.17

ATCA: PICMG 3.0

PICMG 2.16, H.110

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- STMP

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- Hotswap, N+1
- Removable filter

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- 48VDC input
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- UL, CSA, CE
- NEBS Level III

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- *Fully PICMG 3.0 system management spec-compliant*
- *PICMG 2.9-compliant*

Different TOEs for different folks

By Al Basseri

As Moore's Law has proven, processor performance doubles every 18 months. This has inevitably caused an application performance challenge. It has taken a compute bound problem and changed it to an I/O bound problem. I/O storage and server manufacturers have recognized this and have been addressing this issue as the I/O bottleneck grows worse each day. Compare this problem to that of city and state transportation planners who have realized the rapid growth and subsequent daily traffic bottlenecks in major metropolitan areas such as Silicon Valley. These bottlenecks have hurt the long-term growth and stability of the area. As a result, businesses have partially or completely moved away from the Silicon Valley because of the high cost of operations and overall diminished ROI.

Just as transportation planners struggle to come up with alternative solutions to address the bottleneck, many hardware manufacturers have faced similar challenges. Unfortunately, most have not learned from the mistakes that city planners have made in the past. Simply building more housing or roads has not addressed the problem. Building new roads and then restricting the types of traffic that can move through these roads only creates new standards and adds another level of complexity. Yet, the fundamental problem still exists. Similarly in computer architecture, the problem is not simply storage, but it also involves server-to-server traffic.

The majority of I/O bound problems today are Ethernet based TCP/IP traffic. It is the processing for the transport layer and the link layer that are increasing the load on the host CPU and indirectly affecting the application performance. Mission-critical network applications require support for a high number of concurrent sessions while maintaining acceptable throughput.

Common TOE designs

TCP/IP Offload Engine (TOE) solutions offload TCP/IP processing from the host CPU, increase network throughput, and in essence, create more CPU cycles for application processing. Refer to Figure 1 for an overview of the key benefits derived from utilizing TOE. Many TOE developers have addressed the bottleneck issue strictly from a storage point of view by focusing on applications with few concurrent sessions and large data transfers. Just as most roads are packed with lots of cars and not larger vehicles, the typical mission-critical network application is being occupied by an increasing number of concurrent TCP sessions carrying small TCP packets over IP. Most available TOE designs cannot address the issue in the high-session count environment. Yet a majority of the I/O bottleneck occurs in such an environment.

Another drawback of many TOE designs in today's market involves the need for large buffer memory for TCP segment reassembly to address dropped, or out of order segments. Since the required buffer size is dependent on the TCP connection bandwidth and the end-to-end delay, the buffer grows with the network's speed resulting in higher costs. In addition, as the number of connections increases the performance drops. As it turns out, the bandwidth required to support that level of memory is at least twice the wire speed, requiring a complicated high-speed memory design. In this case, the TOE needs hardware in order to inter-

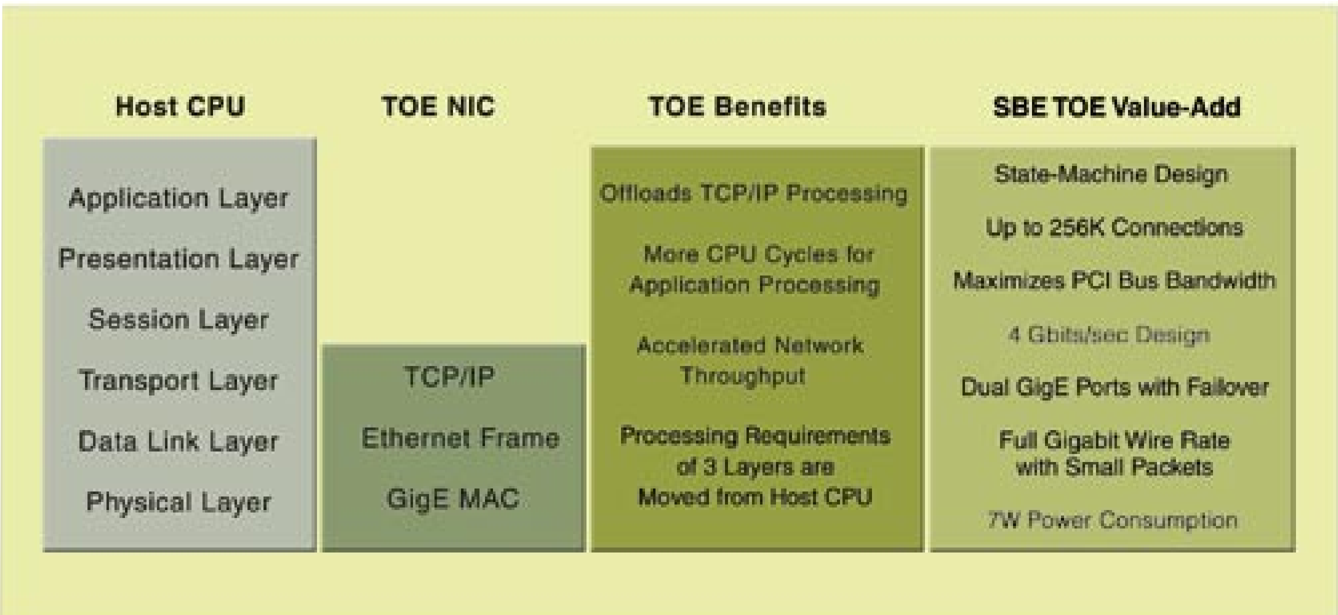

Figure 1

face to larger and wider memory, further elevating development time and costs.

Optimizing TOE for high session count applications

The optimal solution to the high session count problem is to design a fast-through TOE. A fast-through TOE allows all of the data, whether in-order or out-of-order, to be processed immediately from the TOE to host memory. This eliminates the additional cost and complexity associated with introducing a TCP reassembly buffer. To achieve this immediate result, SBE is developing a TOE solution that processes information from each TCP segment it receives immediately, without requiring a larger buffer. Figure 2 illustrates the general architecture of the SBE TOE solution. SBE's TOE board is based on a state machine design that supports up to 250,000 concurrent sessions while maximizing the bandwidth of the existing bus. More importantly, all of this occurs while consuming as little as 7W of power. It is a simple and effective solution for addressing high traffic loads on individual servers. Now as far as Silicon Valley traffic goes that problem will be for the new California Governor.

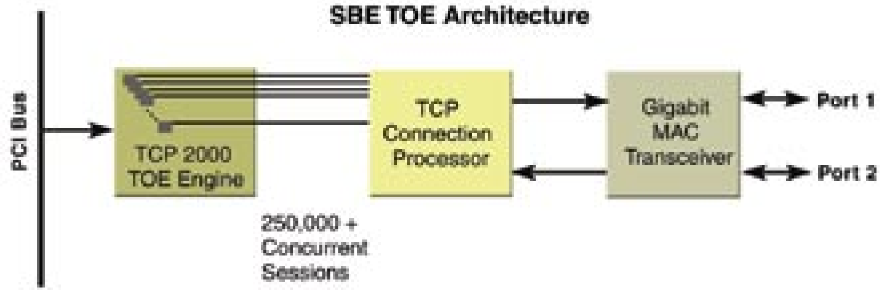

Figure 2

__Al Basseri__ has more than 10 years of management experience in marketing and support involving enterprise software, security, and storage area networks. At SBE, Al manages the strategic business development and product strategy for enterprise solutions, including TCP/IP Offload Engine. Prior to joining SBE, Al held key positions at industry leading companies, including BEA Systems. He holds a Computer Science degree from San Jose State University and has written numerous papers on enterprise support methodologies.

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Company Name	Web Site	Datacom													
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Acromag	www.acromag.com										✓				
Actis	www.actis-computer.com				✓			✓			✓				
ACTTechnico	www.acttechnico.com				✓						✓				
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Concurrent Technologies	www.gocct.com				✓				✓		✓				
Connect Tech	www.connecttech.com										✓				

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Company Name	Web Site	Datacom													
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Continuous Computing	www.ccpu.com				✓										
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				✓							
✓											
										✓	
								✓			

DATACOM PRODUCTS

Meilhaus Electronic GmbH ME-9000

National Instruments PXI-8231/8232

DATACOM

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Meilhaus Electronic	www.meilhaus.com										✓				
MEN Micro	www.menmicro.com				✓						✓				
Meret Optical Communications	www.osicom.com				✓				✓						
MOSCHIP	www.moschip.com												✓		
N.A.T.	www.nateurope.com		✓		✓						✓				
National Instruments	www.ni.com				✓		✓				✓				
NextNine	www.rtview.com														
NMS Communications	www.nmscommunications.com											✓			
Odin TeleSystems	www.OdinTS.com								✓						
One Stop Systems	www.onestopsystems.com										✓				
OSE Systems	www.ose.com														
Performance Technologies	www.pt.com							✓			✓			✓	
Pericom	www.pericom.com				✓										
Pickering Interfaces	www.pickering.co.uk														
Precision Communications, Inc.	www.precisioncomm.com				✓										
Pulse	www.pulseeng.com			✓											
QLogic Corp.	www.qlogic.com														
Quatech	www.quatech.com										✓				

Continued on page 30

Other											
Embedded Internet	Hubs	Internet Appliances	Modem + Protocol Stack	Modem/Fax Modem	Proprietary	Protocol Stack	Remote Access	Routers/Switches	Security	Switch Matrix/Array	TCP/IP
	✓							✓			
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Company Name	Web Site	Datacom													
		Arcnet	ATM	DSL	Ethernet	FDDI	GPIB/MXI	Intelligent Com. Controller	LAN	MAN	Serial Controller	Software	USB Controller	WAN	WLAN
Rabbit Semiconductor	www.rabbitsemiconductor.com				✓										
Radstone Technology	www.radstone.co.uk		✓		✓										
SBC Designs	www.sbcdesigns.com				✓										
SBE	www.sbei.com								✓					✓	
SBS Technologies	www.sbs.com				✓						✓			✓	
Sealevel Systems	www.sealevel.com										✓				
Siemens	www.siemens.com								✓						
Sixnet	www.sixnetio.com				✓										
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SMC Networks	www.smc.com														✓
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Soltec	www.solteccorp.com				✓										
Spider Software	www.artesyncp.com														
Synergy Microsystems	www.synergymicro.com				✓						✓				
Systran	www.systran.com								✓		✓				
Team Solutions	www.team-solutions.com						✓								
Technobox	www.technobox.com				✓						✓				
Tecnint	www.tecnint.it					✓					✓				
TEK Microsystems	www.tekmicro.com										✓				
Telebyte Technology	www.telebyteusa.com				✓										
Tenta Technology	www.tenta.com										✓				
Thales Computers	www.thalescomputers.com				✓										
The Software Group Limited	www.wanware.com													✓	
Tricom Technology	www.tricomtech.com								✓						
TriEMS	www.triems.com														
Tyco Electronics	www.tycoelectronics.com				✓										
Vista Controls	www.vistacontrols.com										✓				
Voiceboard	www.voiceboard.com											✓			
VXI Technology	www.vxitech.com														
Wavecom	www.wavecom.com														
Woodhead	www.woodhead.com				✓										
Xycom	www.xycom.com										✓				
Zephyr Engineering	www.zpci.com														
ZNYX	www.znyx.com				✓										

Other											
Embedded Internet	Hubs	Internet Appliances	Modem + Protocol Stack	Modem/Fax Modem	Proprietary	Protocol Stack	Remote Access	Routers/Switches	Security	Switch Matrix/Array	TCP/IP
					✓		✓	✓			
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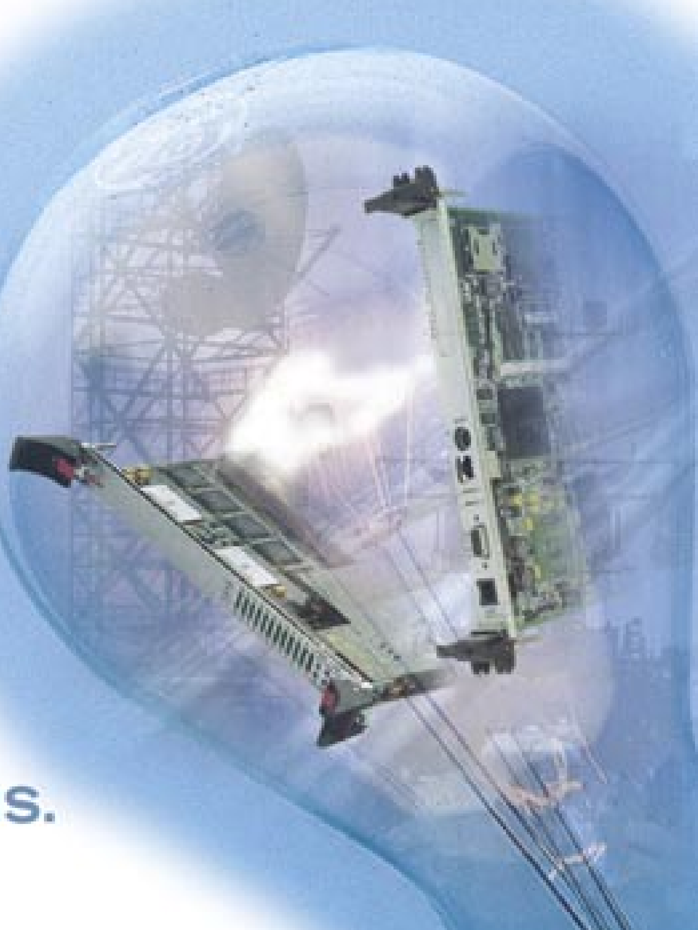
DATACOM



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Real-time control system for lithography stepper machines

By Abdelilah Aadil

Since the IC first became commercially available in 1961, it has undergone remarkable change. The IC has become incredibly small and can now incorporate millions of transistors, offering unbelievable performance in myriad applications. The original IC, by comparison, only housed one transistor, three resistors, and one capacitor.

Today, ICs are used in all kinds of electronic products and systems, from personal computers and mobile phones to televisions, air conditioners, and other appliances. They can also be found in video game systems, automobiles, corporate and government information systems, factory automation, and other industrial applications. Virtually every element of the infrastructure that supports our daily lives contains ICs.

There is a direct link between the evolution of the integrated circuit and that of electronic products and systems. The microprocessors that are used in the personal computers of today, for example, integrate more than 50 million transistors and feature operating frequencies some 20,000 times faster than the ICs of the early 1960s. Personal computers built around these new, more powerful ICs can send and receive music or video data, download software, and they allow users to enjoy online games and take advantage of other useful, innovative Internet-based applications, delivering the blazing speed users today demand. The super-powerful ICs of today have also made possible exciting new portable products such as digital still and video cameras, PDAs (Personal Digital Assistants), and digital audio devices, as well as home entertainment appliances like digital TVs and DVD recorders.

The significant increase in the performance of ICs (number of transistors per chip and density) and processors, in terms of MIPS that practically double every 1.5 to 2 years, as well as the marked decrease in the cost of production, is due primarily to the huge strides made in manufacturing technology. These strides have also been the catalyst in the propagation of electronic products and systems. Semiconductor manufacturers have faced and are still facing big challenges in finding lithography stepper solutions that can meet their technology, production, and cost needs. This poses a considerable challenge to lithography tool manufacturers by keeping up the product improvement process while driving down the cost of ownership. The two most important features for improvement in a lithography stepper machine are:

- High resolution and wide exposure fields (wafer support, projection lens)
- Throughput and machine stability (number of wafers per hour, vibration, and temperature)

The throughput, the productivity of a lithography stepper machine, is heavily dependent on the performance of the computer control system. This machine component is responsible for controlling and monitoring all other components making user's experiments precise and speedy.

The computer control system consists of two layers of hierarchy, the user interface computer (UIC) and the machine interface unit (MIU). The UIC layer is mostly based on a PC serving as a terminal that provides various kinds of graphical interface windows for the user to control and analyze the measured data with. The UIC is linked to the MIU via a serial connection (remote control).

The MIU is basically a standards-based embedded single board computer system such as VME and CompactPCI. The data acquisition and processing in real-time make the PowerPC architecture the most adopted platform technology in these computer controlled lithography applications. The control of the stepper motors and their scalar motion is done using a PMC I/O card (see Figure 1).

The computing performance of the control unit is highly important for a faster and more accurate positioning of the wafer stage. A fast execution of the acquired data and shorter reaction time (feedback control) enables a fast machine throughput.

Current state-of-the-art semiconductor projection lithography employs line widths and positioning accuracy in the 100nm range. The basic concept of the control system consists of two sets of position sensors that monitor the position of an XY grid encoder, an integral part of the XY stage that supports the wafer, and monitor the X and Y coordinates. Both types of position sensors have sub-nanometer resolution and a repeatability of a few nanometers. The XY encoder sensors can monitor the position over the full size of the wafer.

The position sensors feeds the sensing signal back to the PMC I/O card, where the position of the mechanical stages in real time is done by the MIU using linear step motors. The high resolution results in large data inputs that require large bandwidth on the hardware side. Having two decoupled PMC channels on the single board computer (PowerPC CPCI-695 or CPU-695-VME from Force Computers) carrying the PMC I/O cards is a huge advantage. Also, the implementation of the PCI-X technology enables more than 16 Gbits/sec aggregate throughputs at a maximum frequency of 133MHz.

Achieving sub-nanometer positioning requires a device to shift from today's paradigm of optical lithography techniques, causing a data-handling problem. Tailoring the system to take advantage of the chip repetitions over the wafer as much as possible requires an effective way of making the data, or pattern-data available, and reduces the frequency of storing data to a disk when the data volume exceeds the memory size. Having a control system featuring a large, fast memory like DDR SDRAM with up to 4 Gbytes memory and a maximum bandwidth of 25.6 Gbytes/sec (Force Computers CPCI-695, CPU-695-VME) is a real relief for system architects of lithography stepper machines.

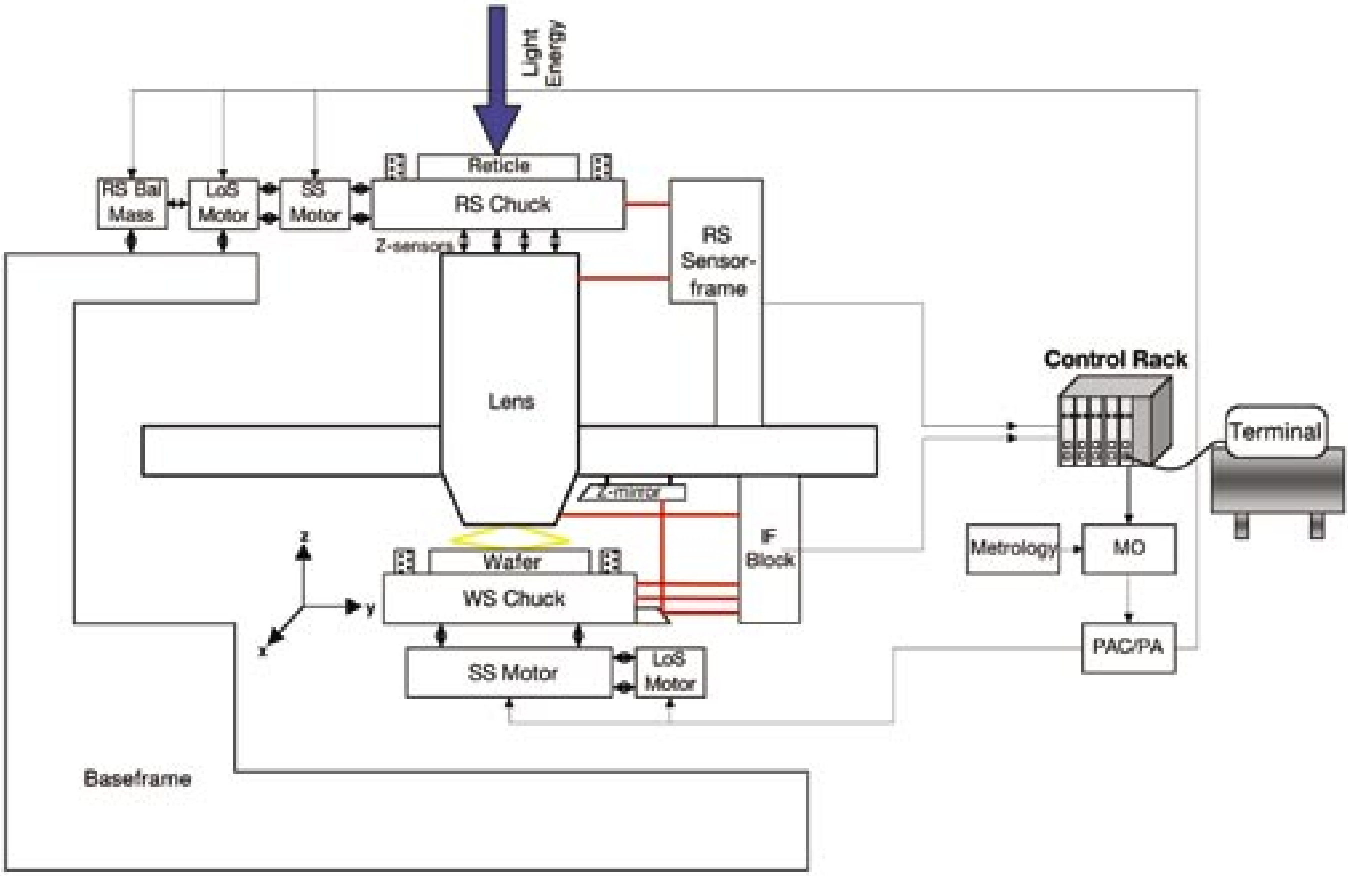

Figure 1

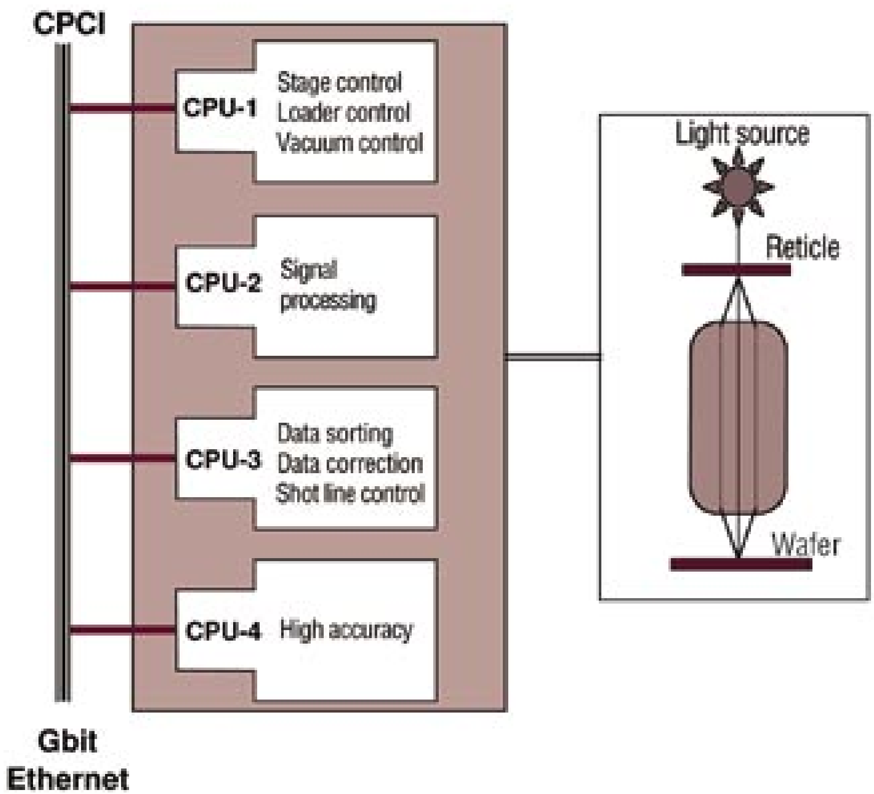

Figure 2

The control unit interface system consists of different I/O boards performing different tasks within a lithography machine (see Figure 2). Each SBC is responsible for certain functions or group of functions. These functions can include diagnostics, gathering system-related information such as application's task status or statistics, and calculating the XYZ positioning. Position stages where the control system reads the voltage from all relevant potentiometers, converts them into positions, and displays these values in terms of millimeters to the user display screen is one example of these responsibilities. The SBC can also compare the magnet position with the user set point values. Then if the magnet position is not within the five micron tolerance limit, the program calculates the new displacement before converting it to micro-stepping motor pulses, with optimum speed and acceleration curve set points, and sends the new value to the motor controller.

The communication media between the different nodes of the control unit is CompactPCI, VME, or Ethernet. This common interface is basically used to exchange data.

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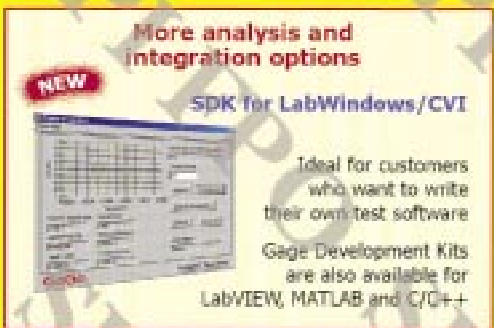

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A high-bandwidth, fast data transfer media gives the control unit more power and shorter execution time. With the use of a high-bandwidth 64-bit universal CompactPCI bridge, the control system can benefit from the flexibility of using the same SBC either in the system or peripheral slot.

The 64-bit addressing, full speed conversion from 64-bit/33 MHz to 32-bit/66 MHz, and the configurable pre-fetch strategy for improved read performance allows a bandwidth of up to 4 Gbits/sec. This would significantly and positively affect the data traffic between the nodes and in turn improve the performance of the stepper machine control-unit.

The increasing trend of adopting a packet-based technology such as GigE for the data interchange, due to its simplicity and easy migration path, is quite clear. The new generation of PowerPC single board computers (e.g. CPCI-695 and CPU-695-VME) targeting such applications will have to be designed to meet the surge of demand by the system architects for more bandwidth and higher transfer rates.

Conclusion

Since semiconductors continue to ramp up in speed and density, lithography system manufacturers are forced to find out the answer to machine stability, throughput, and high-resolution challenges. Hence, understanding the end-application's needs and bottlenecks helps SBC manufacturers better align their designs and services, therefore responding to the continuous capability enhancements of the real-time control unit.

Abdelilah Aadil *has been with Force Computers since 1998, working in several capacities as a technical account consultant, technical consulting manager, and most recently as a product marketing manager. Prior to joining Force, he spent two years in technical research for Siemens AG.*

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E-mail: info@fci.com
Web site: www.fci.com

Company Name	Web Site	680X0	Blades	Celeron	Coldfire	Crusoe	Dual Pentium	Geode	i960	K5/K6	MIPS	Multiple MPU	Pentium	PowerPC	Socket 370	Socket 7	SPARC	Special Purpose	Tualatin	x86	Xeon	XScale	Other
Actis	www.actis-computer.com													✓									✓
ACTTechnico	www.acttechnico.com		✓																				
Adlink Technology	www.adlinktech.com		✓				✓						✓		✓	✓			✓		✓	✓	
Adtech	www.adtecheng.com														✓								
Adtron	www.adtron.com		✓																		✓		
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Amplicon	www.amplicon.co.uk												✓										
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ELTEC Electronik	www.eltec.de													✓									

Company Name	Web Site	680X0	Blades	Celeron	Coldfire	Crusoe	Dual Pentium	Geode	i960	K5/K6	MIPS	Multiple MPU	Pentium	PowerPC	Socket 370	Socket 7	SPARC	Special Purpose	Tualatin	x86	Xeon	XScale	Other
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esd	www.esd-electronics.com													✓									
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Inova	www.inova-computers.de			✓						✓			✓	✓									
Integrated Device Technology	www.idt.com										✓												
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Miriac	www.miriac.com													✓									
Momentum Computer	www.momenco.com										✓			✓			✓						
Motorola Computer Group	mcg.motorola.com		✓	✓									✓	✓									✓
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Performance Technologies	www.pt.com		✓				✓						✓										

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Continued on page 42

Company Name	Web Site	680X0	Blades	Celeron	Coldfire	Crusoe	Dual Pentium	Geode	i960	K5/K6	MIPS	Multiple MPU	Pentium	PowerPC	Socket 370	Socket 7	SPARC	Special Purpose	Tualatin	x86	Xeon	XScale	Other
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AdvancedTCA and AdvancedMC provide robust, scalable telecom platform

By Jeff Durst

The year of 2003 was the year of PICMG 2.16. 2004 will usher in a new era, establishing AdvancedTCA (PICMG 3.0) and Advanced Mezzanine Card (AdvancedMC, or PICMG AdvancedMC) as the dominant platform for high-availability telecom applications.

Unlike many of their predecessors, AdvancedTCA and AdvancedMC are not buses in search of an application. They are not a modification and retrofit of general-purpose platforms in hopes of appealing to telecom OEMs either. AdvancedTCA and AdvancedMC are a system platform and expansion architecture designed by telecom for telecom. They spring from a collaboration of major telecom OEMs and suppliers aimed at developing an optimal telecom platform that addresses major bandwidth, availability, field upgradeability, cost, scalability, management, and interoperability issues.

AdvancedTCA has made substantial progress in the last year. In late 2002, PICMG gave approval to the base spec (PICMG 3.0), and the first alpha products were seen. In 2003, the first beta products and approval for a variety of protocols that will operate over AdvancedTCA's high-speed fabric, including Ethernet/Fibre Channel (PICMG 3.1), InfiniBand (PICMG 3.2), StarFabric (PICMG 3.3), and PCI Express (PICMG 3.4) have come to fruition. In the coming months, PICMG will finalize the RapidIO (PICMG 3.5) sub spec, and they will also resolve the sticky connector IP issue. Creating an IP-free connector specification to facilitate reasonable and nondiscriminatory licensing rights will pave the way for widespread product availability in 2004.

AdvancedTCA isn't the first open-architecture platform to target the telecom industry, but it is the first platform designed from the ground up for telecom. CompactPCI Packet Switching Backplane (cPSB or PICMG 2.16), for example, is an adaptation of the general-purpose CompactPCI bus that adds telecom-friendly features such as Ethernet backplane transfers (PICMG 2.16) and system management (PICMG 2.9). By contrast, AdvancedTCA integrated system management and support for multiple protocols are parts of the baseline spec. In addition, AdvancedTCA provides much higher throughput (10 Gbit/sec vs. 1 Gbit/sec per link), supports a full mesh interconnect (in addition to 2.16's Dual Star), accommodates higher power (up to 200W versus 50W), and provides a larger form factor (8U versus 6U), all of which are invaluable for telecom applications.

The AdvancedMC expansion interface, slated for PICMG adoption in Q2 of 2004, makes AdvancedTCA even more attractive by enhancing its scalability, flexibility, and field upgradeability. By combining a general-purpose AdvancedTCA carrier card with application-specific AdvancedMC modules, designers can create versatile telecom blades whose functionality and/or capacity can be upgraded without replacing the entire blade.

With AdvancedMC, designers are free to create scalable, high-density modules dedicated to a specific function, such as control, SIGTRAN signaling, transcoding, interfacing, or packet processing. They can also combine multiple functions on a single blade and alter the mix as applications and/or system partitioning changes. Artesyn expects that blades combining an AdvancedTCA carrier with AdvancedMC modules will be the best fit (vis-à-vis fixed-function AdvancedTCA cards) for up to 80% of telecom applications. These modular blades will cost a bit more, but the ability to upgrade and scale them will far outweigh this incremental initial cost premium.

AdvancedMC is optimized for high-performance packet-based telecom environments, but TDM emulators are available for interacting with the PSTN. AdvancedMC modules communicate with the AdvancedTCA baseboard via a packet-based serial interface. Ethernet is the defacto protocol, but the AdvancedMC interface can support any number of protocols, including PCI Express, RapidIO, and InfiniBand. AdvancedMC modules are hot swappable FRUs (field replaceable units), enabling them to be replaced individually in the field. They also provide an IPMI-based interface, enabling them to be remotely monitored and maintained via Remote Access System Management (RASM).

The idea of an expansion module isn't new. PMC, for example, is the expansion module of choice for VMEbus, CompactPCI, cPSB (PIGMG 2.16) and many custom designs. PMC even has an offshoot for telecom applications called PTMC (PCI Telephony Mezzanine Card) that brings a TDM bus up to the module along with other optional interfaces such as RMII or Utopia. However, even with these enhancements for telecom, PMC isn't ideal for telecom. For one thing, PMC uses PCI as the control plane bus, and consumes extra management resources. Equally important, PMC modules aren't hot swappable, and the spec only allows 7.5W per module.

AdvancedMC modules can be used to provide a broad range of processor (such as CPUs, network processors, and DSPs), coprocessor (such as encryption/decryption engines), LAN/WAN (such as Ethernet, OC-x/STM-x, T1/E1, and Fibre Channel), and mass storage options. This flexibility makes the modules very easy to integrate at the system level.

Figure 1 shows how an AdvancedTCA card equipped with AdvancedMC mod-

ules might be used to implement a scalable signaling blade. The server modules runs the upper level signaling stacks such as SS7 MTP3, SCCP, ISUP, TCAP, and/or MAP. The signaling modules run the lower level signaling protocol such as SS7 MTP1 and MTP2. Mass storage devices log blade and signaling link activity.

Component suppliers have been trying for almost two decades to create an open architecture platform for telecom systems that would entice telecom OEMs to use off-the-shelf solutions. At long last, close collaboration between component suppliers and telecom OEMs has produced such a platform. With an eye toward high performance, availability, integrated system management, and field upgradeability, AdvancedTCA carriers equipped with application-specific AdvancedMC modules provide the consummate foundation for building telecom blades. These blades provide the scalability and flexibility needed to power next-generation packet networks. Ultimately, AdvancedTCA and AdvancedMC will lower the life-time cost of ownership by leveraging efficiencies and reducing time to market, allowing TEMs to outsource enabling technology, lowering maintenance costs, and providing a roadmap to future technologies.

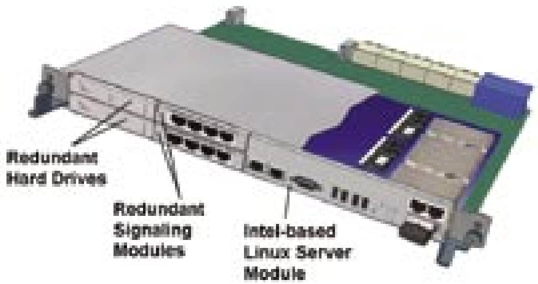

Figure 1

Jeff Durst *has been with Artesyn Communication Products for 17 years. Since joining the company in 1986 he has served the company in systems engineering, hardware engineering, and engineering project management. Jeff moved to marketing in 1999, focusing his efforts on new product definition by establishing the market, direction, and subsequent technology roadmap for the Artesyn product lines. Jeff acts as the main liaison between Artesyn's engineering and marketing organizations, serves as Artesyn's representative on PICMG's executive subcommittee, and participates in PICMG specification subcommittees.*

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Web site: www.artesyncp.com

Company Name	Web Site	AdvancedTCA	Fibre Channel	Infiniband	PCI Express	PICMG 2.16 Ethernet	RACEway	RapidIO	SCRAMNet	StarFabric
ACTTechnico	www.acttechnico.com		✓							
Advantech	www.advantech.com					✓				
Agilent	www.agilent.com			✓						
Ancot	www.ancot.com		✓							
Apcon	www.apcon.com		✓							
apra-norm	www.apra.de	✓								
APW Electronic Solutions	www.apw.com	✓								
Aurora Technologies	www.auroratech.com									✓
Bustronic	www.bustronic.com	✓								✓
Carlo Gavazzi	www.gavazzi-mupac.com	✓				✓				✓
CATC	www.catc.com		✓							
CIPRICO	www.ciprico.com		✓							
Critical I/O	www.criticalio.com		✓							
Delphi Engineering	www.DelphiEng.com		✓							
Diversified Technology	www.dtims.com	✓								
DRS	www.drs.com						✓			
DSPCon	www.dspcon.com		✓							
Dy 4	www.dy4.com		✓							✓
Echotek	www.echotek.com						✓			
ELMA Electronic	www.elma.com	✓				✓				✓
Emulex	www.emulex.com		✓							
ERNI	www.erni.com	✓								
Force Computers	www.forcecomputers.com	✓				✓				
GE Fanuc Automation	www.gefanuc.com/embedded	✓	✓	✓		✓				
General Micro Systems	www.gms4vme.com					✓				
GNP	www.gnp.com	✓				✓				
Great River Technology	www.greatrivertech.com		✓							
Hybricon	www.hybricon.com									✓
IBM	www.ibm.com							✓		

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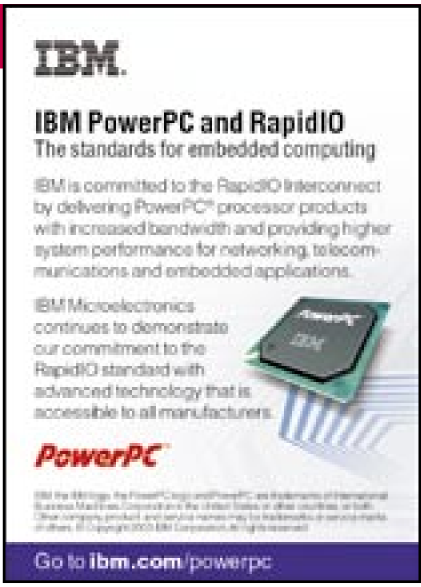

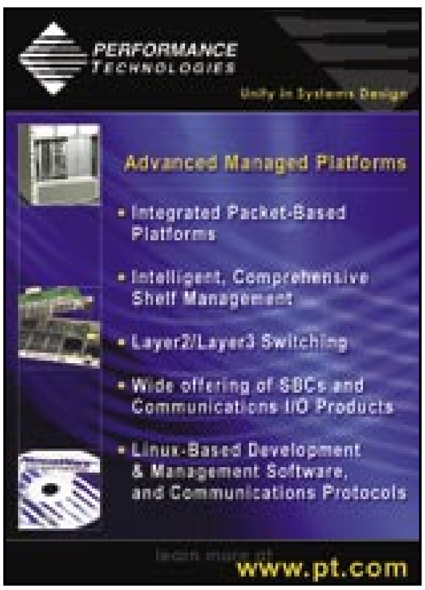

BUYER'S GUIDE

Company Name	Web Site	AdvancedTCA	Fibre Channel	Infiniband	PCI Express	PICMG 2.16 Ethernet	RACEway	RapidIO	SCRAMNet	StarFabric
Intel	www.intel.com	✓				✓				
Interphase	www.interphase.com	✓	✓							
Kaparel	www.kaparel.com									✓
Medea Corporation	www.medea.com		✓							
Mellanox	www.mellanox.com			✓						
Mercury Computer Systems	www.mc.com		✓				✓			
Motorola Computer Group	mcg.motorola.com			✓						
PCI Embedded	www.pcisystems.com									✓
Pentek	www.pentek.com						✓			
Performance Technologies	www.pt.com					✓				
Picor	www.picorpower.com	✓								
Pigeon Point Systems	www.pigeonpoint.com	✓								
RadiSys Corp	www.radisys.com					✓				
Radstone Technology	www.radstone.co.uk		✓							
SBS Technologies	www.sbs.com		✓			✓				
Schroff US	www.schroff.us	✓								
Silicon Image	www.siimage.com		✓							
Solflower Computer	www.solflower.com									✓
StarGen	www.stargen.com									✓
Synergy Microsystems	www.synergymicro.com									✓
Systran	www.systran.com		✓				✓		✓	
TEK Microsystems	www.tekmicro.com						✓			
Tundra Semiconductor	www.tundra.com							✓		
Unison Information Systems	www.unisoninfo.com		✓							
Vitesse Semiconductor	www.vitesse.com		✓							
VRose Microsystems, Inc.	www.vrosemicrosystems.com									✓
XILINX	www.xilinx.com				✓					
Xyratex	www.xyratex.com		✓							
ZNYX	www.znyx.com					✓				

RSC# 201 @www.compactpci-systems.com/rsc

Electronic enclosure packaging trends in 2004

By Justin Moll

For the electronic enclosure packaging industry, 2004 is going to be an exciting year. There are many technological advancements and important products that will hit the market. AdvancedTCA, Serial RapidIO, VXS, and PCI Express will all have an impact on our market in the coming year. Some will see a full ecosystem available; others will just be starting to get off the ground. Technological trends in basic silicon such as integrated signal conditioning, the rollout of new commercial platforms such as PCI Express, enhancements to GigE, and wireless networks are just a few of the forces that will continue to reshape our market.

This year saw many important steps forward in the above technologies, as well as many others. In 2003, AdvancedTCA took several leaps forward. Dual Star and Mesh AdvancedTCA backplanes are now available in various sizes such as 2-, 5-, 6-, and 14-slots. AdvancedTCA chassis have been developed in 3U, 4U, 5U, 12U, and 13U heights, with various configurations. Now one can even use an AdvancedTCA Development Chassis for prototyping or testing, with A/C converters for plugging to a conventional wall outlet. Shelf managers are also available that have been specifically designed for the PICMG 3.0 specification, utilizing redundant radial or bussed IPMB's and dual 48VDC power feeds.

In PICMG 2.16 packaging also advanced in 2003, mainly on the backplane side. There are a wide range of configurations now available. For example, one can find low profile 4-slot and 8-slot PICMG 2.16 backplanes for 2U and 4U horizontal chassis respectively. Also, the shelf managers mentioned above have been integrated into PICMG 2.0/2.16/2.17 solutions. There are even backplanes designed to easily plug or cable to shelf managers in these systems. 2003 saw similar expansion of configurations for StarFabric PICMG 2.17.

What should the industry see in 2004? Expect to see some critical leaps forward. For example, several companies have recently announced switch and node cards for AdvancedTCA, enabling the AdvancedTCA ecosystem to overcome an important hurdle. Packaging companies will have more opportunities to develop new units in various configurations, offering more choices for the market. PCI Express over AdvancedTCA will help bring further interest and momentum to the technology. PLX Technology Inc. is already performing live demonstrations of PCI Express over AdvancedTCA in an Elma Electronic Inc. chassis. In 2004, StarFabric cards over AdvancedTCA with PICMG 3.3 implementations might also be seen.

There have been a few delays for VXS (VME Switched Serial) in 2003. However, the connector issues seem to be resolved and backplane/chassis configurations will hit the market soon. Many hope to see Serial RapidIO silicon in early 2004 to utilize over VXS. Expect to see VXS configurations in 12-, 20-, and 21-slot backplanes initially and perhaps some smaller implementations as well.

Another trend in the market is the growing acceptance of CompactPCI in COTS chassis for military and security. Particularly in network security applications, CompactPCI backplanes are increasingly incorporated in 1U and 2U horizontal chassis, and various other configurations. Communications-based and network secu-

rity-based COTS chassis should continue this trend, providing a rugged solution with the required I/O, hot-swap capability, and performance.

On the technology front, higher processing power is leading to more stringent EMC requirements and superior thermal management. Packaging specialists are being asked to maintain EMC effectiveness over a wider frequency spectrum, with the requirements exceeding 10 GHz at times. It is important to tackle EMC objectives early in the design stage. For thermal management, 6U form factor processor boards are migrating from approximately 40W per board to anywhere around 60 to 70W per board. This trend requires higher performance fans and monitoring/control. A few years back, alarm output fans like tachometer output fans and lock rotor output fans were the exception, whereas today they are the rule (for most telecom enclosures). Redundancy in cooling is also increasingly sought after to enhance system reliability. In addition to all of the above approaches, to ensure optimal thermal management, it is advisable to simulate the cooling for new enclosure designs and subsequently perform testing to validate the outcome.

Backplane bandwidth and reliability requirements are also increasing. It will be important to choose a vendor with experience in high-speed design. As differential signaling usage increases, and more complex routing strategies are employed,


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backplane companies will need to utilize powerful design capture and routing software. To provide the essential quality and tight tolerances in these designs, vendors should use up-to-date equipment and techniques. For example, a quality oven capable of providing uniform solder reflow for thick backplanes with high copper content should be used. Powerful simulation software and accurate testing equipment also figure significantly in quality high-speed backplane design.

In 2004 and beyond, it will be important to select a packaging company with experience developing modular, high-performance solutions. As EMC, thermal management, system management, and higher bandwidth are increasingly important in tomorrow's systems, it's vital to balance this criterion effectively to optimize the solution. Further, it will be critical to choose vendors that are stable and growing in capability by investing in efficient equipment, key technologies, and agile manufacturing software. Look for 2004 to be an exciting and eventful year for electronics packaging.

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***Justin Moll** has over nine years of high-tech marketing and sales experience and has been the marketing manager for Bustronic since 2000. He is also the PR Manager for parent company Elma Electronic Inc. Previous positions include marketing services manager for E21 Corporation and account manager for Elcon Products International, now a Tyco Electronics company. Justin received his Bachelor of Science degree in Business Administration from the University of California, Riverside.*

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Web site: www.elma.com
Web site: www.bustronic.com

Diversified Technology, Inc. cPS-8161

Xtech Extruded Aluminum Enclosures

Company Name	Web Site	Backplanes							Connector						
		Accessories	Backplanes	H.110	Hot-Swap Compliant	Serial Mesh	Switched Fabric	Transceiver	Backplane	Backplane to PS	Coding Keys	Hard Metric	Mezzanine	PC/104	Other
3M	www.3M.com								✓						
3Y Power Technology	www.3ypower.com														
Absopulse Electronics	www.absopulse.com														
Acqiris	www.acqiris.com														
Action Instruments	www.actionio.com														
Actis	www.actis-computer.com														
ACTTechnico	www.acttechnico.com														
Adaptec	www.dpt.com														
Adas	www.adas.fr														
Adlink Technology	www.adlinktech.com				✓										
Adtron	www.adtron.com														
Advanced Power Solutions	www.advpower.com														
Advantech	www.advantech.com	✓													
AeroComm	www.aerocomm.com							✓							
Agilent	www.agilent.com														
Alphi Technology	www.alphitech.com														
American Rugged Enclosures	www.areinc.com														
Amphenol	www.amphenol.com														✓
Amtelco	www.amtelco.com				✓										
AP Labs	www.aplabs.com														
APC	www.apcc.com														
apra-norm	www.apra.de		✓												
APW Electronic Solutions	www.apw.com	✓	✓	✓	✓		✓				✓				
ARC	www.arc.com														
Asine	www.asinegroup.com														
AVX Corporation	www.avxcorp.com								✓	✓	✓	✓			✓
Axiom Technology	www.axiomtek.com				✓										
Az-Com	www.az-com.com								✓						
Belobox Networks	www.belobox.com														
BI RA Systems	www.bira.com														
Bivar	www.bivar.com														
Bud Industries	www.budind.com														
Bus Solutions Ltd	www.bus-solutions.co.uk														
Bustronic	www.bustronic.com	✓	✓	✓	✓		✓								

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PACKAGING

Mass Storage							Other																	
CD-ROM Drive	Controller	IDE	Plug-in Unit	RAID	SAN	Solid State Disk	Board Accessories	Card Rack Accessories	Card Rack/Subrack	Enclosure	Enclosure & CR & PS	Equipment Rack	ESD Management	Front-Panel Hardware	IEEE 1394 (FireWire)	Keyboard Interface	Power Inverter	Power Supply	Power-Fail Module	Production Tools	SCSI Controller	SCSI Peripheral	Shrouds	Thermal Management
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Company Name	Web Site	Backplanes							Connector						
		Accessories	Backplanes	H.110	Hot-Swap Compliant	Serial Mesh	Switched Fabric	Transceiver	Backplane	Backplane to PS	Coding Keys	Hard Metric	Mezzanine	PC/104	Other
BVM	www.bvmltd.co.uk														
BWI	www.bwi.com														
C&D Technologies	www.cdpoweronline.com														
Carlo Gavazzi	www.gavazzi-mupac.com	✓	✓		✓		✓								
Catapult	www.catapult.com														
Celestica	www.celestica.com														
Centralp Automatismes	www.centralp.com														
Channel Access	www.channelaccess.com														
Cherokee International	www.cherokeellc.com														
Chroma ATE	www.chromaate.com														
Chroma Systems Solutions	www.chromausa.com														
C-MAC of America	www.cmac.com		✓												
Comm Con Connectors	www.commcon.com								✓						
Concurrent Technologies	www.gocct.com														
Condor Power Supplies	www.condorpower.com														
Continuous Computing	www.ccpu.com														
Creative Electronic Solutions	www.ces.ch														
Crystal Group	www.crystalpc.com														
CTS	www.ctsclearone.com	✓													
Cyberchron	www.cyberchron.com														

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PACKAGING

Mass Storage							Other																	
CD-ROM Drive	Controller	IDE	Plug-in Unit	RAID	SAN	Solid State Disk	Board Accessories	Card Rack Accessories	Card Rack/Subrack	Enclosure	Enclosure & CR & PS	Equipment Rack	ESD Management	Front-Panel Hardware	IEEE 1394 (FireWire)	Keyboard Interface	Power Inverter	Power Supply	Power-Fail Module	Production Tools	SCSI Controller	SCSI Peripheral	Shrouds	Thermal Management
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Company Name	Web Site	Backplanes							Connector						
		Accessories	Backplanes	H.110	Hot-Swap Compliant	Serial Mesh	Switched Fabric	Transceiver	Backplane	Backplane to PS	Coding Keys	Hard Metric	Mezzanine	PC/104	Other
Cyclone Microsystems	www.cyclone.com														
Dawn VME Products	www.dawnvme.com				✓										
DENSAN Systems	www.densan.com		✓		✓										
Digital Power	www.digipwr.com														
Diodes	www.diodes.com	✓													
Diversified Technology	www.dtims.com														
Dot Hill	www.dothill.com														
Drake Communication Products	www.drake-dcpi.com														
DSPCon	www.dspcon.com														
Echotek	www.echotek.com														
EIC Solutions	www.eicsolutionsinc.com														
EKF-Electronik	www.ekf.de														
Electro-Space Fabricators	www.esfinc.com														
Elgar	www.elgar.com														
ELMA Electronic	www.elma.com		✓	✓	✓		✓								
EPT USA	www.ept.de								✓	✓	✓	✓		✓	✓
ERNI	www.erni.com								✓	✓		✓			✓
esd	www.esd-electronics.com														
EuroTecH	www.eurotech.it														
ExaDrive Networks	www.exadrive.com														
Fairchild Semiconductor	www.fairchildsemi.com														
FCI	www.fciconnect.com								✓	✓		✓	✓		
Fujikura America	www.fujikura.com											✓			
Fujitsu Takamisawa America	www.fujitsu.takamisawa.com														
Gage	www.gage-applied.com														
Ganymed	www.ganymed.com														
Gaurang	www.gaurang.com														✓
GE Fanuc Automation	www.gefanuc.com/embedded		✓												
General Dynamics	www.gdcanada.com														
General Micro Systems	www.gms4vme.com														
Geotest	www.geotestinc.com														
GESPAC	www.gespac.ch				✓										
Globalux	www.globaluxind.com														
Globe Brackets	www.globebrackets.com														

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Mass Storage							Other																	
CD-ROM Drive	Controller	IDE	Plug-in Unit	RAID	SAN	Solid State Disk	Board Accessories	Card Rack Accessories	Card Rack/Subrack	Enclosure	Enclosure & CR & PS	Equipment Rack	ESD Management	Front-Panel Hardware	IEEE 1394 (FireWire)	Keyboard Interface	Power Inverter	Power Supply	Power-Fail Module	Production Tools	SCSI Controller	SCSI Peripheral	Shrouds	Thermal Management
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Company Name	Web Site	Backplanes							Connector						
		Accessories	Backplanes	H.110	Hot-Swap Compliant	Serial Mesh	Switched Fabric	Transceiver	Backplane	Backplane to PS	Coding Keys	Hard Metric	Mezzanine	PC/104	Other
GNP	www.gnp.com	✓				✓									
Gompf Brackets	www.bracket.com														
Hagiwara	www.hsc-us.com														
Hapco	www.hapco.com														
Harting	www.harting.com								✓	✓	✓	✓			✓
Hartmann Elektronik	www.hartmann-elektronik.de		✓	✓											
Hirose Electric	www.hirose.com								✓	✓					
Hitek Power	www.hitekp.com														
Hoffman	www.hoffmanonline.com														
Honda Connectors	www.hondaconnectors.com											✓			
Hybricon	www.hybricon.com		✓		✓		✓								
I-BUS	www.ibus.com				✓										
ICP America	www.icpamerica.com														
Inova	www.inova-computers.de		✓												
Integrated Device Technology	www.idt.com		✓												
Integrated Power Systems	www.ipsi.net														
Intel	www.intel.com														
Interlogic Industries	www.infoview.com														
Intermas	www.intermas.com														
Interphase	www.interphase.com														
Intersil	www.intersil.com														
ITenclosures	www.itenclosures.com		✓												
ITOX	www.itox.com														
Jasper Electronics	www.jasperelectronics.com														
JMR Electronics	www.jmr.com														
Kaparel	www.kaparel.com		✓	✓			✓								
KEL Connectors, Inc.	www.kel.jp														✓
Keystone Electronic	www.keyelco.com	✓													
Kinetic Computer	www.kin.com														
Knurr USA	www.knurr.com														
Kontron	www.kontron.com		✓												
Lambda Electronics	www.lambdapower.com														
Lanner Electronics	www.lannerinc.com		✓		✓										
Leader Tech	www.leadertechinc.com														

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Mass Storage							Other																	
CD-ROM Drive	Controller	IDE	Plug-in Unit	RAID	SAN	Solid State Disk	Board Accessories	Card Rack Accessories	Card Rack/Subrack	Enclosure	Enclosure & CR & PS	Equipment Rack	ESD Management	Front-Panel Hardware	IEEE 1394 (FireWire)	Keyboard Interface	Power Inverter	Power Supply	Power-Fail Module	Production Tools	SCSI Controller	SCSI Peripheral	Shrouds	Thermal Management
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PACKAGING

Company Name	Web Site	Backplanes							Connector						
		Accessories	Backplanes	H.110	Hot-Swap Compliant	Serial Mesh	Switched Fabric	Transceiver	Backplane	Backplane to PS	Coding Keys	Hard Metric	Mezzanine	PC/104	Other
LSI Logic	www.lsilogic.com														
LV Power	www.lvpower.net														
MagneTek	www.magnetekpower.com														
Magtech	www.magtechind.com														
MarekMicro	www.marekmicro.de		✓												
Measurement Computing	www.measurementcomputing.com														
Mektron Systems	www.mektron.co.uk														
MEN Micro	www.menmicro.com														
Meritec	www.meritec.com												✓		✓
Metrowerks	www.metrowerks.com														
MGV Stromversorgungen	www.mgv.de														
Miltron Systems	www.miltron.com														
Mindready Solutions	www.mindready.com														
Molex	www.molex.com								✓						
Motorola Computer Group	mcg.motorola.com														
M-Systems	www.m-sys.com														
Murrelektronik	www.murrinc.com														
National Instruments	www.ni.com		✓												
NEXCOM International	www.nexcom.com		✓		✓										
Nexsan	www.nexsan.com														
One Stop Systems	www.onestopsystems.com		✓	✓											
Oupiin	www.oupiin.com											✓			
Pentek	www.pentek.com														
Performance Technologies	www.pt.com						✓								
Pericom	www.pericom.com														
Perlos Connectors	www.perlos								✓		✓				
Phillips Components	www.phillipscomponents.net														
Phoenix International	www.phenxint.com														
Pinnacle Data Systems	www.pinnacle.com														
Polyonics	www.polyonics.com														
Polyrack	www.polyrack.com				✓										
Positronic Industries	www.connectpositronic.com								✓	✓					✓
Power Innovations	www.power-innovations.com														
Powerbox	www.powerbox.com														

Continued on page 62

PACKAGING

Mass Storage							Other																	
CD-ROM Drive	Controller	IDE	Plug-in Unit	RAID	SAN	Solid State Disk	Board Accessories	Card Rack Accessories	Card Rack/Subrack	Enclosure	Enclosure & CR & PS	Equipment Rack	ESD Management	Front-Panel Hardware	IEEE 1394 (FireWire)	Keyboard Interface	Power Inverter	Power Supply	Power-Fail Module	Production Tools	SCSI Controller	SCSI Peripheral	Shrouds	Thermal Management
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Company Name	Web Site	Backplanes							Connector						
		Accessories	Backplanes	H.110	Hot-Swap Compliant	Serial Mesh	Switched Fabric	Transceiver	Backplane	Backplane to PS	Coding Keys	Hard Metric	Mezzanine	PC/104	Other
Power-One	www.power-one.com														
Precision Communications, Inc.	www.precisioncomm.com		✓												
Pulse	www.pulseeng.com														✓
Purcell Brackets	www.purcellbrackets.com														
PXIT	www.pxit.com														✓
QLogic Corp.	www.qlogic.com														
RadiSys Corp	www.radisys.com														
Rancho Technology	www.rancho.com														
Raycon Technology	www.raycontech.com											✓			
Red Rock Technologies	www.RedRockTech.com														
Rittal	www.rittal.corp.com		✓		✓										
SAE Power	www.saepower.com														
Saelig	www.saelig.com														✓
SANBlazeTechnology, Inc.	www.sanblaze.com														
SBC Designs	www.sbcdesigns.com														
SBS Technologies	www.sbs.com	✓													✓
Schaefer	www.schaeferpower.com														
Schaffner EMC	www.schaffner.com														
Schroff US	www.schroff.us		✓		✓										
SimpleTech	www.simpletech.com														
SMA	www.SMAcomputers.com		✓												
Sorensen	www.sorensen.com														
StacoSwitch	www.stacoswitch.com														
Switching Power	www.switchpwr.com														
Synergy Microsystems	www.synergymicro.com														
Targa Systems	www.targasystems.com														
Team Solutions	www.team-solutions.com														
Technobox	www.technobox.com												✓		✓
Teka Interconnection	www.tekais.com								✓						
Tenta Technology	www.tenta.com														
Teradyne	www.teradyne.com								✓						
TK Power	www.tkpower.com														
Tracewell Systems	www.tracewellsystems.com		✓	✓	✓		✓								
Transtech DSP	www.transtech-dsp.com														

Continued on page 64

Mass Storage							Other																	
CD-ROM Drive	Controller	IDE	Plug-in Unit	RAID	SAN	Solid State Disk	Board Accessories	Card Rack Accessories	Card Rack/Subrack	Enclosure	Enclosure & CR & PS	Equipment Rack	ESD Management	Front-Panel Hardware	IEEE 1394 (FireWire)	Keyboard Interface	Power Inverter	Power Supply	Power-Fail Module	Production Tools	SCSI Controller	SCSI Peripheral	Shrouds	Thermal Management
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Company Name	Web Site	Backplanes							Connector						
		Accessories	Backplanes	H.110	Hot-Swap Compliant	Serial Mesh	Switched Fabric	Transceiver	Backplane	Backplane to PS	Coding Keys	Hard Metric	Mezzanine	PC/104	Other
Tri Source	www.trisourceinc.com														
Trilogic Systems	www.trilogicsystems.com						✓								
Triple E	www.tripleease.com				✓										
Twin Industries	www.twinhunter.com		✓										✓		
Tyco Electronics	www.tycoelectronics.com								✓	✓		✓			✓
Unipower	www.unipower-corp.com														
United Electronic Industries	www.ueidaq.com														
Universal Air Filter Co.	www.uaf.com														
Vector Electronics	www.vectorelect.com		✓												
VersaLogic	www.versalogic.com														
Winchester Electronics	www.winchesterelectronics.com								✓	✓	✓	✓			
Xtech	www.xtech-outside.com														

RSC# 64 @www.compactpci-systems.com/rsc

Mass Storage							Other																	
CD-ROM Drive	Controller	IDE	Plug-in Unit	RAID	SAN	Solid State Disk	Board Accessories	Card Rack Accessories	Card Rack/Subrack	Enclosure	Enclosure & CR & PS	Equipment Rack	ESD Management	Front-Panel Hardware	IEEE 1394 (FireWire)	Keyboard Interface	Power Inverter	Power Supply	Power-Fail Module	Production Tools	SCSI Controller	SCSI Peripheral	Shrouds	Thermal Management
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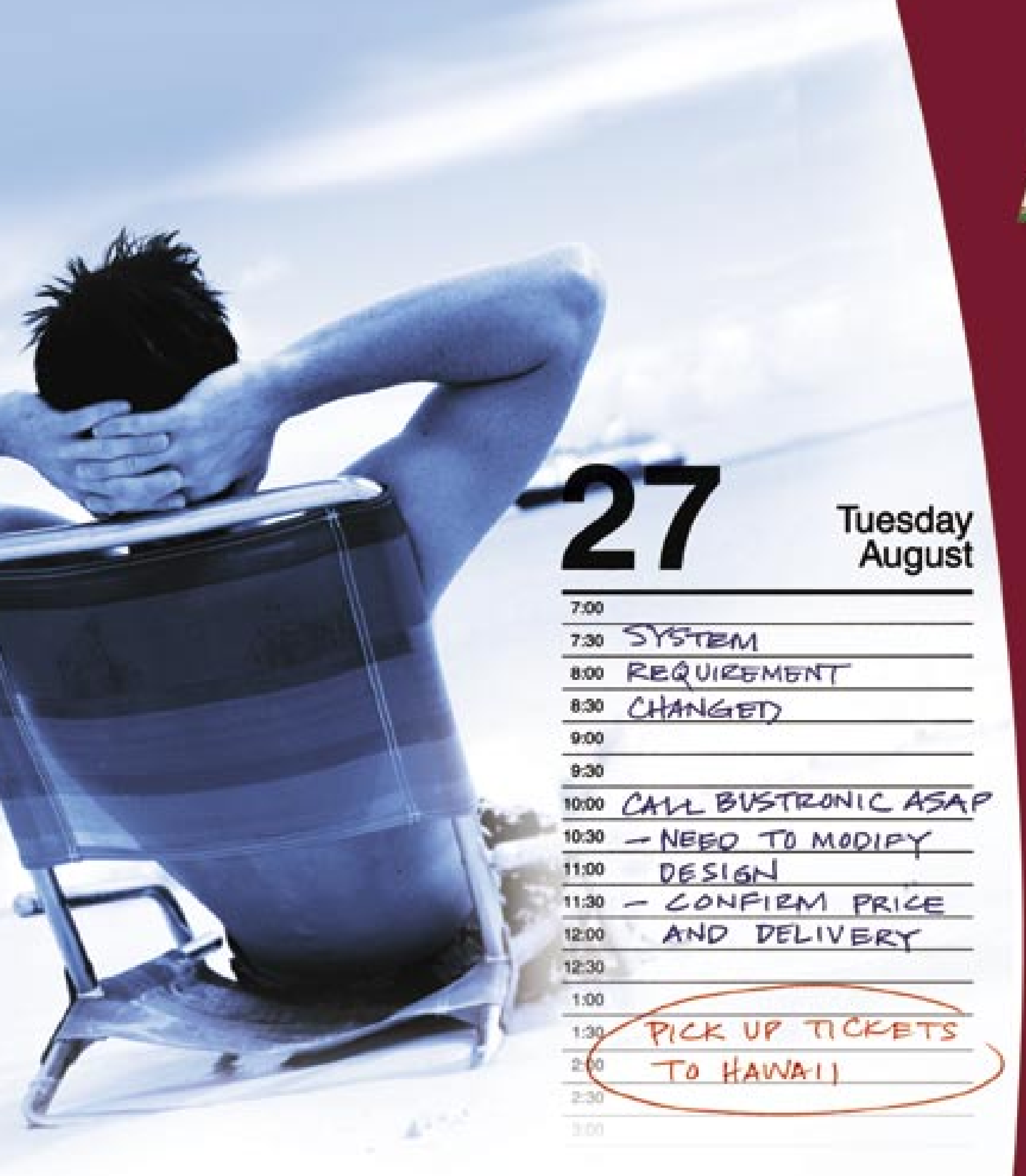
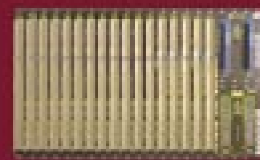
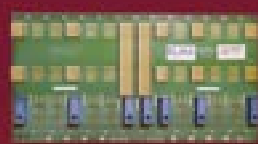



VME


CompactPCI


Switched Fabrics


Custom

A versatile approach to instrumentation

By Sacha Veillette

Signal processing, communication ports, bus interfaces, image processors, graphics controllers, analog I/O modules, digital I/O modules, signal conditioning, storage (flash memory or even removable hard disks for intelligence applications); this is just a short list of the realm of possibilities offered by the addition of mezzanine cards on a carrier.

As one contemplates the growing demand for flexibility, scalability, COTS content, and obsolescence-proofing of test systems and instrumentation, one can deduce that carriers and mezzanine cards such as PMCs are clearly at the forefront of technology development. It is an exciting subset of the industry where much has been achieved already, and much remains possible for the future.

Although not yet a provider of carrier or mezzanine cards, Gage Applied Technologies is quite impressed by what can be done through such an approach and is evaluating ways to use PMCs to increase the connectivity and throughput of existing and future data acquisition systems.

Carrier and mezzanine cards, what are they good for?

Carrier and mezzanine cards have many applications. The main advantage they bring to test systems is an ability to evolve with the changing application requirements. The carrier and mezzanine(s) card approach provides room for growth. Over time, it is possible to change the processing power, or the resolution and speed of analog capture channels, etc. A system conceived for one application may be adapted to the requirements of another simply by changing the mezzanine, thus preserving an investment made in learning how to program a processor mounted on the carrier.

With developments in RF communications and radar applications often stemming from military requirements, the throughput of existing platforms like VXI and PCI (and related families like PXI) is often proving insufficient to the task of extracting intelligence from the signals. By placing processors (or dedicated DSP chips, versatile FPGAs, etc.) in close proximity to the data-capture and signal-generation hardware, the capture-analysis-response loop closes tight. The controlling PC throughput requirement significantly decreases.

I like to think of carriers plus PMCs (or other mezzanine cards) as mini synthetic instruments. A typical example would be a software radio that relies on great processing power integrated with digitizers and synthesizers.

As a colleague from our sister company KineticSystems pointed out, it is also interesting to see carriers designed to take a module from a different platform (say PXI 3U) and use it like a mezzanine card for integration into a VXI test system. This is an approach we are trying with an intelligent carrier from C&H Technologies and our own 6U CompactPCI products. This is done using the carrier and its microprocessor to extract valuable information from the rich data stream of our ultra-fast digitizers. I believe this is just one way to expand the already powerful concept of carrier and mezzanine card solutions.

Too many choices?

There appears to be a downside to such versatility however. While a system or a synthetic instrument can be easily upgraded through hardware substitution, there arises a further and often complex integration requirement. The programming effort can be substantial, and often requires expertise that resides exclusively with the original equipment supplier, thereby creating a locking-in mechanism.

Another challenge for test system users and integrators comes from the sometimes daunting task of deciding on the specific architecture to adopt. For instance, should one choose a DSP on the carrier and I/O on the mezzanine, or I/O on the carrier and PMCs to add DSP capabilities to the radar system? Versatility is a double-edged sword where the situation is complicated by the varying preferences of vendors, and the lack of a standard architecture for carrier-mezzanine solutions.

A bright future

The combination of carriers and mezzanine cards is a proven approach that provides design versatility and plenty of growth potential. There is no doubt in my mind that combining carriers and mezzanine cards offers a powerful solution to many instrumentation requirements, integrating small size, high throughput, and expansion room for the changing requirements of mission-critical applications. It is an approach that, without blind acceptance, more manufacturers should add to their arsenal of solutions to instrumentation challenges.

Sacha Veillette *is the marketing manager at Gage Applied Technologies, Inc. Joining Gage in 2001, Sacha brought with him a diversified background including research in particle physics, project management in engineering, and leading a software development venture. He holds Master's degrees in both Physics and Engineering, the latter being a joint program MBA-EE, from the University of British Columbia in Vancouver, Canada.*

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Canada
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Fax: 514-633-1414
E-mail: sacha.veillette@gage-applied.com
Web site: www.gage-applied.com

THE CARRIER BOARD AND MEZZANINE CHARTS START ON PAGE 70

Company Name	Web Site	Carrier Boards								
		IP	IP (Intelligent)	M-Module	Other	PC/104	PC•MIP	PMC	PMC (Intelligent)	TIM
Acromag	www.acromag.com	✓								
ACS-Tech 80	www.acs-tech80.com	✓								
Actis	www.actis-computer.com	✓								
Active Silicon Limited	www.activesilicon.co.uk									
ACTTechnico	www.acttechnico.com							✓		
Aculab	www.aculab.com				✓					
Adas	www.adas.fr				✓					
Adcom	www.adcomtec.com									
Adlink Technology	www.adlinktech.com									
Advantech	www.advantech.com/epc							✓		
AIM USA	www.aim-online.com									
Aitech	www.rugged.com									
Alacron	www.alacron.com									
Alpha Data	www.alpha-data.co.uk									
Alphi Technology	www.alphitech.com	✓	✓							
American ELTEC	www.eltec.de/us									
AppTech	N/A									
Artesyn Communication	www.artesyncp.com							✓		
Artesyn Technologies	www.artesyn.com									
Asine	www.asinegroup.com									
AudioCodes	www.audiocodes.com									
Aurora Technologies	www.auroratech.com									
BittWare	www.bittware.com									
Brandywine Communications	www.brandywinecomm.com									
BVM	www.bvmltd.co.uk							✓		
BWI	www.bwi.com		✓					✓		
C&H Technologies	www.chtech.com	✓		✓						
Catalyst Enterprises	www.catalyst-ent.com									
CCII	www.ccii.co.za									
Centralp Automatismes	www.centralp.com							✓		
Channel Access	www.channelaccess.com									
CML Versatel	www.cmlversatel.com									
Computer Modules	www.compumodules.com									
Concurrent Technologies	www.gocct.com				✓		✓	✓	✓	
Condor Engineering	www.condoreng.com									
Coreco Imaging	www.imaging.com									
Creative Electronic Systems	www.ces.ch							✓		
Cyclone Microsystems	www.cyclone.com									
Data Device	www.ddc-web.com									
Datum	www.datum.com									

Continued on page 72

Mezzanines										
CCPMC	Connectors	IP	M-Module	Other	PC•MIP	PCI-X	PMC	PrPMC	PTMC	Switched Fabric
		✓					✓			
		✓								
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Company Name	Web Site	Carrier Boards								
		IP	IP (Intelligent)	M-Module	Other	PC/104	PC•MIP	PMC	PMC (Intelligent)	TIM
Delphi Engineering	www.DelphiEng.com									
DNA Enterprises	www.dna-cs.com									
Dolphin Interconnect Solutions	www.dolphinics.com									
Domain Technologies	www.domaintec.com									
DRS	www.drs.com									
DSPCon	www.dspcon.com									
DSS Networks	www.dssnetworks.com									
Dy 4	www.dy4.com							✓		
Dynamic Engineering	www.dyneng.com	✓						✓		
Dynatem	www.dynatem.com									
Echotek	www.echotek.com									
EKF-Electronik	www.ekf.de				✓		✓			
ELMA Electronic	www.elma.com									
Eonic Systems	www.eonic.com									
esd	www.esd-electronics.com									
EuroTecH	www.eurotech.it							✓		
Excalibur Systems	www.mil-1553.com									
Extreme Engineering	www.xes-inc.com							✓	✓	
FCI	www.fciconnect.com									
Force Computers	www.forcecomputers.com									
FuturePlus Systems	www.futureplus.com									
GE Fanuc Automation	www.gefanuc.com/embedded							✓		
General Micro Systems	www.gms4vme.com							✓		
General Standards	www.generalstandards.com									
GESPAC	www.gespac.ch				✓					
GET Engineering	www.getntds.com									
Great River Technology	www.greatrivertech.com									
ImageStream	www.imagestream.com									
Inducom AcQ	www.acq.nl									
Inova	www.inova-computers.de				✓					
Integrated Device Technology	www.idt.com									
Intel	www.intel.com							✓		
Interactive Circuits & Sys.	www.ics-ltd.com									
Interay BV	www.interay.com									
Interface Concept	www.interfaceconcept.com							✓		
Interphase	www.interphase.com							✓		
Iskratel	www.iskratel.ru									
iWave Systems	www.iwavesystems.com									
Janz Computer	www.janzag.de									
Kane Computing	www.kanecomputing.com									

Continued on page 74

Mezzanines										
CCPMC	Connectors	IP	M-Module	Other	PC•MIP	PCI-X	PMC	PrPMC	PTMC	Switched Fabric
							✓			
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Company Name	Web Site	Carrier Boards								
		IP	IP (Intelligent)	M-Module	Other	PC/104	PC•MIP	PMC	PMC (Intelligent)	TIM
Kontron	www.kontron.com							✓		
Leutron	www.leutron.com									
Mapletree Networks	www.mapletree.com									
MAX Technologies	www.maxt.com		✓							
Media Cybernetics	www.mediacy.com									
MEN Micro	www.menmicro.com			✓			✓			
Meret Optical Communications	www.osicom.com									
Meritec	www.meritec.com									
Micro Memory	www.umem.com									
Mindready Solutions	www.mindready.com	✓								
Momentum Computer	www.momenco.com									
Motorola Computer Group	mcg.motorola.com							✓		
N.A.T.	www.nateurope.com								✓	
National Instruments	www.ni.com				✓					
Netbricks	www.netbricks.net									
North Atlantic Industries	www.naii.com									
Odin TeleSystems	www.OdinTS.com									
Orion Technologies	www.otisolutions.com									
PCI Embedded Computer Systems	www.pcisystems.com				✓					
Pentek	www.pentek.com									
Performance Technologies	www.pt.com									
Peritek	www.peritek.com							✓		
PLDApplications	www.plda.com									
Precision Communications, Inc.	www.precisioncomm.com					✓	✓			
Primagraphics	www.primag.co.uk									
Prodrive	www.prodrive.nl									
Purcell Brackets	www.purcellbrackets.com									
RadiSys Corp	www.radisys.com									
Radstone Technology	www.radstone.co.uk									
Rapid Technology	www.rapid-technology.com									
Reasearch Center "Module"	www.module.ru									
Red River	www.red-river.com									
RT Logic!	www.rtlogic.com									
Rymic	www.rymic.com									
Sabtech Industries	www.sabtech.com									
Sanblaze	www.sanblaze.com									
SBE	www.sbei.com							✓		
SBS Technologies	www.sbs.com	✓					✓	✓		
Schroff US	www.schroff.us									
Spectrum Sig. Proc.	www.spectrumsignal.com									

Continued on page 76

Mezzanines										
CCPMC	Connectors	IP	M-Module	Other	PC•MIP	PCI-X	PMC	PrPMC	PTMC	Switched Fabric
							✓			
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Company Name	Web Site	Carrier Boards								
		IP	IP (Intelligent)	M-Module	Other	PC/104	PC•MIP	PMC	PMC (Intelligent)	TIM
Sundance DSP	www.sundance.com									✓
Synergy Microsystems	www.synergymicro.com							✓		
Systran	www.systran.com	✓						✓		
Technobox	www.technobox.com				✓			✓		
TEK Microsystems	www.tekmicro.com									
Tews Technologies	www.tews.com	✓						✓		
Thales Computers	www.thalescomputers.com							✓		
Titan	www.titan.com									
Transtech DSP	www.transtech-dsp.com							✓		
Traquair Data Systems	www.traquair.com				✓					
TriEMS	www.triems.com									
Twin Industries	www.twinhunter.com									
Valley Technologies	www.pmcmodules.com				✓					
Varisys Ltd	www.varisys.co.uk							✓		
Veridian Systems	www.veridian.com									
Vigilant Technologies	www.vigilanttech.com									
Vista Controls	www.vistacontrols.com									
VMETRO	www.vmetro.com									
Voiceboard	www.voiceboard.com									
VRose Microsystems, Inc.	www.vrosemicrosystems.com									
Wind River	www.windriver.com							✓		
Xalyo Systems	www.xalyo.com									
Xycom	www.xycom.com									
Zephyr Engineering	www.zpci.com							✓		
ZNYX	www.znyx.com									

Mezzanines										
CCPMC	Connectors	IP	M-Module	Other	PC•MIP	PCI-X	PMC	PrPMC	PTMC	Switched Fabric
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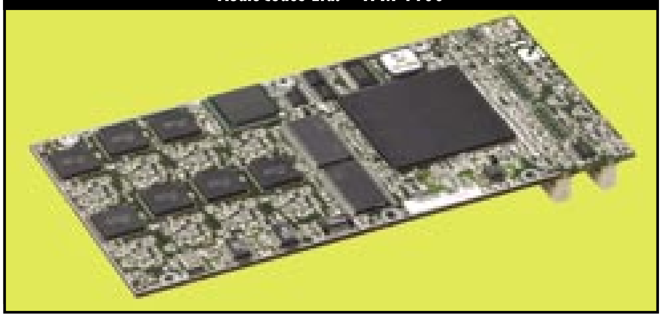
PRODUCTS

Thales Computers PMC -SIO

Acromag, Inc. PMC424/464

AudioCodes Ltd. TPM-1100



CARRIER & MEZZANINE/PMC PRODUCTS

Interface Concept IC-PQ2-PMCa

Radisys Corporation EXS-6424

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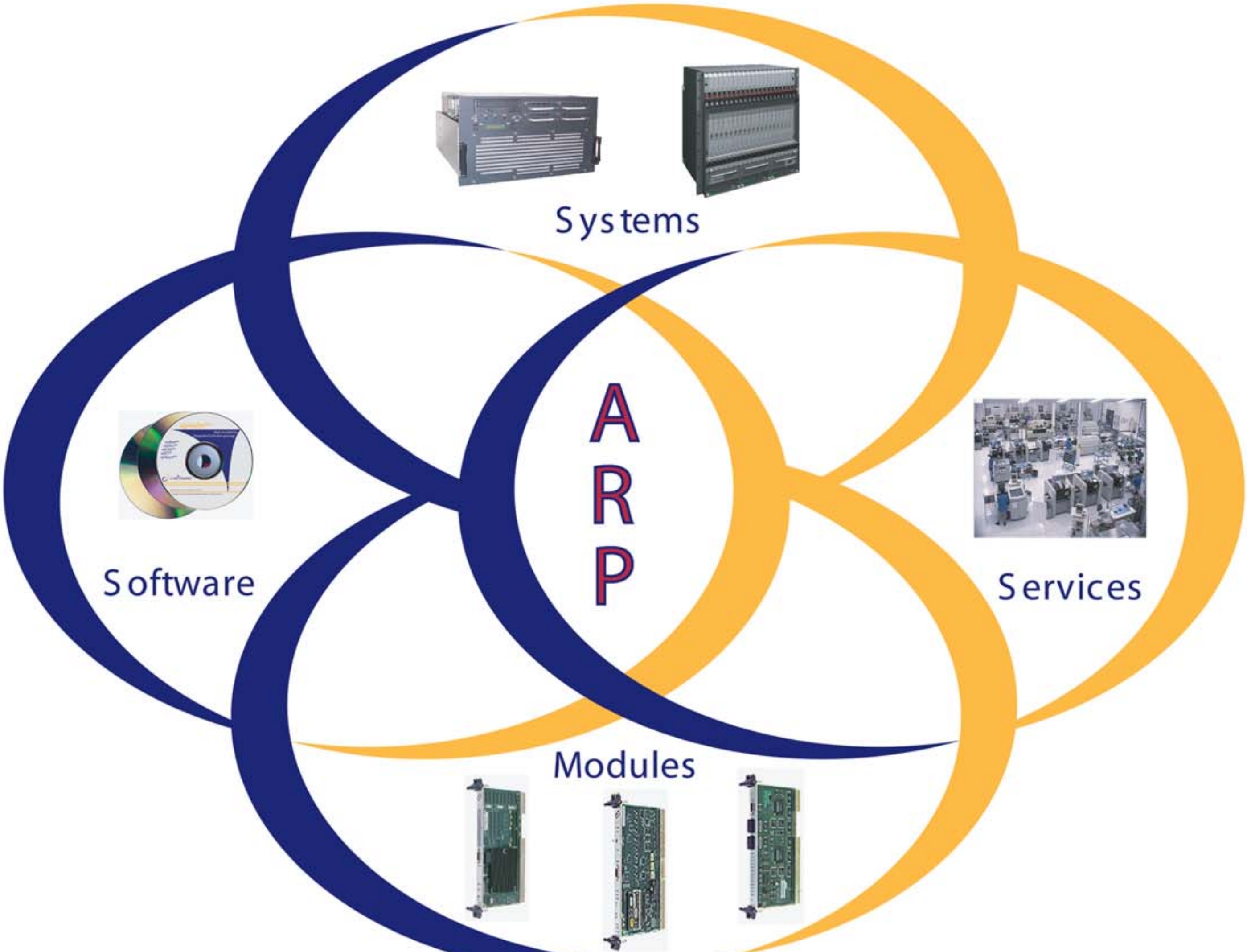

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The future of Boundary Scan

By Heiko Ehrenberg

Today's production environments and manufacturing schedules force test engineers to provide flexible low-cost test solutions in the shortest possible time. Time-to-market is of the essence more than ever, and every step involved in getting products out to the end user needs to be streamlined. These steps include design entry, prototype verification, production, final assembly, and also test and debugging at various stages throughout this process. For example, concurrent design and development of circuitry, product casing, as well as firmware and user software can shorten the product design cycle. Thinking in the early stages of product design about the test strategies to be applied in design, prototyping, manufacturing, and field-testing avoids costly delays as well as insufficient test access and test coverage throughout the product's life cycle. One of the most efficient test technologies for modern electronics is Boundary Scan[1] (IEEE Std. 1149.1, a.k.a. JTAG)[2], targeting many of the problems today's test engineers are facing.

Boundary Scan as board level technology is very well established. In recent years many chip designers started to utilize the Test Access Port (TAP) defined in the IEEE 1149.1 standard, to access self test circuitry built into the Integrated Circuit (IC). This allows designers and test engineers to run the IC's Built-In Self Tests[3] at board and system level. Such tests verify the IC's functionality, often times at functional speed, and the connectivity at chip level. Furthermore, new BIST algorithms developed by various companies also allow the test of board and system level interconnections between ICs at functional speed. (Standard Boundary Scan utilizing the EXTEST instruction can be considered a quasi-static test.)

In addition to connectivity tests, Boundary Scan is also used to program devices such as serial EEPROM and FLASH EEPROM mounted on the PCB (on-board or In-Circuit Programming, ICP). Programming of PLD and FPGA components through their TAP (widely known as In-System Programming) is a well established practice as well and provides the benefit of last-minute changes on firmware, among many other advantages, especially important at the prototyping and design validation stage (as shown in Figure 1).

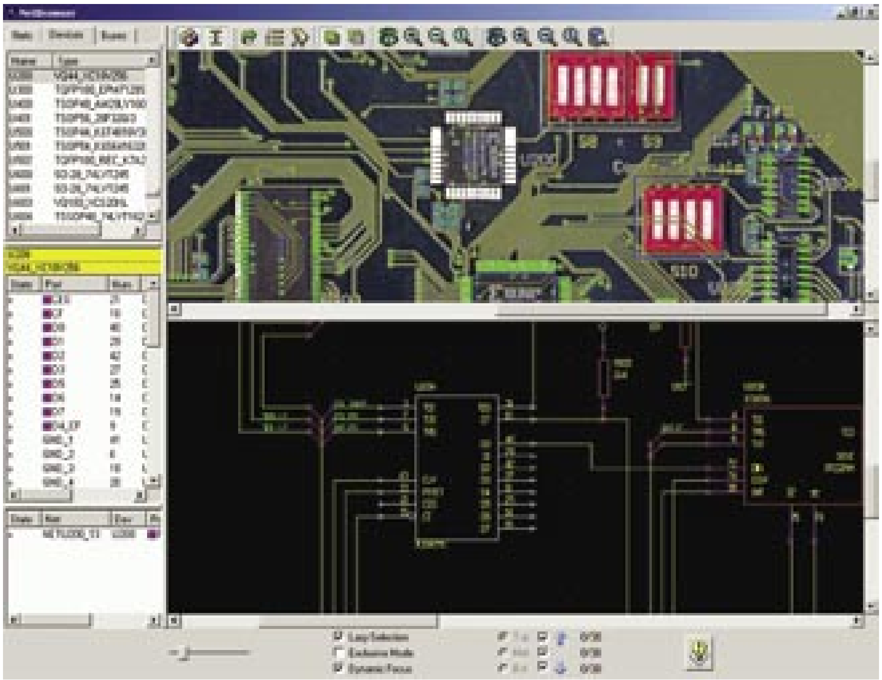

Figure 1

The ingenious way of accessing circuit nodes through Boundary-Scan cells built into ICs lends itself to system level testing as well. Shifting test patterns though a serial scan chain requiring four test bus signals accomplishes this task.[4] Connections between motherboard and daughter cards, or between multiple boards plugged into a system backplane, can easily be tested as long as the system level test bus accessing the various Boundary-Scan chains is designed properly. In addition, such system level access extends the principle of onboard programming to in-system programming and reconfiguration.

Although Boundary Scan provides many benefits for testing modern printed circuit boards, as Figure 2 shows there is always a need for other test methodologies such as functional test, automated optical inspection, or in-circuit test (based on bed-of-nails adapter or flying probes). Using the same test hardware for both Boundary-Scan and complementary test methodologies, and even combining multiple test strategies in one machine, can reduce costs of test setup, handling, and execution time. For example, by combining Boundary-Scan with Flying-Probe Testers, overall test coverage and test execution time can be improved.[5] By combining Functional Testing and Boundary-Scan Testing, new types of tests can be created, simplifying development of Functional Tests and improving test coverage and diagnostics. Automated optical inspection can be used to extend Boundary-Scan test applications to the automated verification of visual features, such as jumper and switch settings, LED and LCD functionality, and so on. These types of tests can be referred to as extended Boundary-Scan applications.

Ideally, the setup of manufacturing test stations using not only Boundary-Scan technology, but also Functional Test and other tools, is low-cost, and provides a high degree of flexibility and modularity.[6] Rack based test stations are common on production floors. Various hardware platforms are in use, such as GPIB, VXI, and more recently PXI.[7] The adoption rate of PXI-based test systems is fast growing even though this hardware platform is only six years old. There is a wide variety of PXI modules available for this young platform. Furthermore, since PXI is based on the CompactPCI specification,[8] CompactPCI modules can also be used in PXI systems and vice versa.

In summary, Boundary Scan is well established throughout the industry. The next step will be to extend its application by combining multiple test technologies and by improving Boundary Scan's ease-of-use, especially in design validation, repair on the manufacturing floor, and in field service.

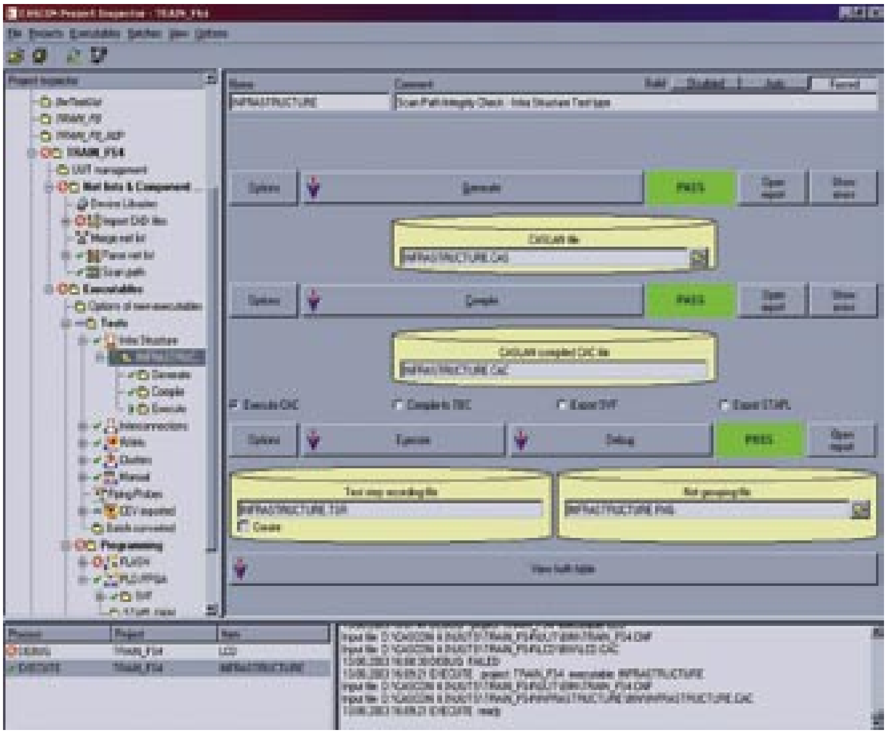

Figure 2

***Heiko Ehrenberg** is the CEO of GOEPEL Electronics LLC, Austin, Texas. His responsibilities include oversight of the technical support efforts for GOEPEL products sold in North America. Heiko received his BSEE (Information Technology) from the University of Applied Science at Mittweida, Germany, in 1996 and started to work for GOEPEL in Germany as an Application Engineer for Boundary Scan technology the same year, before being transferred to the United States in 1998.*

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Web site: www.goepel.com

References

[1] Kenneth P. Parker, *The Boundary-Scan Handbook*, 3rd Edition, 2003, Kluwer Academic Publishers, Norwell, MA, 02061, ISBN: 1-4020-7496-4

[2] IEEE Computer Society, IEEE Standard Test Access Port and Boundary Scan Architecture - IEEE 1149.1 2001, Annex B, IEEE, New York, NY, 2001

[3] Rick Nelson, "Pace your Bets: BIST or scan," *Test & Measurement World*, (June 2003): 35-42, Reed Business Information, Highlands Ranch, CO

[4] Clayton Gibbs, "Backplane Test Bus Applications for IEEE STD 1149.1, Paper 43.1," *International Test Conference 2003 Proceedings*

[5] Tamás Marosvölgyi et al., "Flying Probe and Boundary Scan Testers unite," *Test&Measurement Europe* (August-September 1999)

[6] Heiko Ehrenberg et al., "Incorporating Boundary Scan tools in PXI based ATE systems," *Autotestcon 2003 Proceedings*

[7] PXI System Alliance, PXI Specification, www.pxisa.org/specs.htm

[8] PICMG, Compact PCI Specification, www.picmg.org

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Company Name	Web Site	Telecom				Telephony					Wireless			Other	
		Telecom	OC-3/STM-1	T1/E1	T3/E3	General	VoATM	VoDSL	VoIP	VoP	Wireless	Bluetooth	GSM/GPRS	Gateways	Hot Swap
3-D Engineering	www.3deng.com														✓
Absopulse Electronics	www.absopulse.com	✓													
ACKSYS	www.acksys.fr	✓													
Adax	www.adax.com	✓									✓			✓	
Adlink Technology	www.adlinktech.com													✓	
AeroComm	www.aerocomm.com										✓				
Agere	www.agere.com	✓									✓				
Agilent	www.agilent.com										✓				
Amtelco	www.amtelco.com	✓				✓									
Anatel	www.anatel.com	✓				✓			✓					✓	
Applied Data Sciences	www.appdatsci.com													✓	
APW Electronic Solutions	www.apw.com														✓
Arca Technologies	www.arcatech.com	✓													
Artesyn Communication	www.artesyncp.com	✓	✓											✓	
AudioCodes	www.audiocodes.com						✓		✓					✓	
Brandywine Communications	www.brandywinecomm.com			✓											
Brooktrout	www.brooktrout.com	✓		✓		✓				✓					
BVM	www.bvmltd.co.uk														✓
Catalyst Enterprises	www.catalyst-ent.com														✓
Cirpack	www.cirpack.com													✓	
Commetrex	www.commetrex.com					✓									
Communications Automation	www.cacdsp.com					✓									
Continuous Computing	www.ccpu.com	✓		✓											
CoSystems	www.cosystems.com			✓										✓	
Creative Electronic Systems	www.ces.ch	✓													
Data Kinetics	www.dkl.com	✓													
DENSAN Systems	www.densan.com														✓
Diamond Point	www.dpie.com	✓													
DNA Enterprises	www.dna-cs.com					✓									
Dynamics Research	www.drc.com			✓											
EKF-Electronik	www.ekf.de	✓													
ELMA Electronic	www.elma.com	✓													✓
Ericsson Infotech	www.ericsson.com	✓													
Force Computers	www.forcecomputers.com	✓													
GAO Research	www.gaoresearch.com								✓						
GE Fanuc Automation	www.gefanuc.com/embedded	✓													

Continued on page 84

Company Name	Web Site	Telecom				Telephony					Wireless			Other	
		Telecom	OC-3/STM-1	T1/E1	T3/E3	General	VoATM	VoDSL	VoIP	VoP	Wireless	Bluetooth	GSM/GPRS	Gateways	Hot Swap
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GNP	www.gnp.com								✓					✓	
HA Technical Solutions	www.tech-sol.com	✓													
Infineon	www.infineon.com							✓							
Integrated Device Technology	www.idt.com	✓													
Intel	www.intel.com	✓		✓											
Intermas	www.intermas.com														✓
Interphase	www.interphase.com	✓	✓	✓	✓	✓					✓		✓	✓	
Intersil	www.intersil.com										✓		✓		
Iskratel	www.iskratel.ru								✓						
Kallastra Inc.	www.kallastra.com								✓						
Kalman Saffran & Associates	www.ksa1.com	✓													
Kaparel	www.kaparel.com	✓													
Knurr USA	www.knurr.com	✓													✓
Kontron	www.kontron.com	✓													
Lantronix	www.lantronix.com								✓						
Linear Technology	www.linear-tech.com														✓
Macrolink	www.macrolink.com			✓											
Mapletree Networks	www.mapletree.com	✓													
Merge Technologies Group	www.mergetech.com	✓													
Motorola Computer Group	mcg.motorola.com	✓		✓			✓		✓						✓
N.A.T.	www.nateurope.com	✓		✓											
NMS Communications	www.nmscommunications.com	✓		✓					✓						
Octasic	www.octasic.com								✓						
Odin TeleSystems	www.OdinTS.com	✓													
OSE Systems	www.ose.com										✓	✓			
Performance Technologies	www.pt.com			✓										✓	
Pericom	www.pericom.com	✓													
Pigeon Point Systems	www.pigeonpoint.com														✓
PIKA Technologies	www.pikatechnologies.com					✓									
PLX Technology	www.plxtech.com	✓													✓
PMC-Sierra	www.pmc-sierra.com										✓				
Prisma Engineering	www.prisma-eng.it			✓		✓									
RadiSys Corp	www.radisys.com	✓													
RADVision	www.radvision.com													✓	
Rittal	www.rittal.corp.com														✓

Company Name	Web Site	Telecom				Telephony					Wireless			Other	
		Telecom	OC-3/STM-1	T1/E1	T3/E3	General	VoATM	VoDSL	VoIP	VoP	Wireless	Bluetooth	GSM/GPRS	Gateways	Hot Swap
SBE	www.sbei.com	✓													
SBS Technologies	www.sbs.com				✓										✓
Schroff US	www.schroff.us														✓
Signalogic	www.signalogic.com									✓					
Spectrum Sig. Proc.	www.spectrumsignal.com	✓									✓				
Spider Software	www.artesyncp.com					✓									
Summit Microelectronics	www.summitmicro.com														✓
Sun Microsystems	www.sun.com	✓													
Symmetricom Inc.	www.symmetricom.com	✓													
Synergy Microsystems	www.synergymicro.com			✓											
Telesoft Technologies	www.telesoft-technologies.com	✓		✓		✓									
Texas Instruments	www.ti.com	✓													
Tracewell Systems	www.tracewellsystems.com	✓													
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Ubicom	www.ubicom.com	✓													
Ulticom	www.ulticom.com			✓											
Voiceboard	www.voiceboard.com	✓		✓							✓			✓	
VoicePump	www.voicepump.com								✓						
VXI Technology	www.vxitech.com										✓				
Wavecom	www.wavecom.com										✓				
ZNYX	www.znyx.com	✓				✓									

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Active Silicon Limited	www.activesilicon.co.uk					✓		
ACTTechnico	www.acttechnico.com				✓			
Adlink Technology	www.adlinktech.com				✓	✓		
Agere	www.agere.com		✓					
Aitech	www.rugged.com							✓
Alacron	www.alacron.com						✓	
Arista	www.aristaipc.com			✓				
Aspex Technology	www.aspextechnology.com							✓
BarcoView	www.barcoview.com				✓			
BittWare	www.bittware.com	✓						
Bivar	www.bivar.com			✓				
Brooktrout	www.brooktrout.com		✓					
COGNEX	www.cognex.com					✓		
Colorgraphic Comm	www.colorgraphic.net			✓				
Datapath	www.datapath.co.uk				✓			
Delta Information Systems	www.delta-info.com		✓					
DENSAN Systems	www.densan.com				✓			
Dy 4	www.dy4.com				✓	✓		
esd	www.esd-electronics.com				✓			
Euresys	www.euresys.com					✓		
EuroTecH	www.eurotech.it				✓			
Fairchild Semiconductor	www.fairchildsemi.com			✓				
GE Fanuc Automation	www.gefanuc.com/embedded	✓			✓			
General Micro Systems	www.gms4vme.com				✓			✓
General Standards	www.generalstandards.com				✓			
Inova	www.inova-computers.de			✓				
Jupiter Systems	www.jupiter.com				✓			
Leutron	www.leutron.com					✓		
Matrox	www.matrox.com/Imaging					✓		
National Instruments	www.ni.com					✓		
Octave	www.octave.org		✓					

Continued on page 88

Company Name	Web Site	Audio		Video				
		General	Voice	Display	Display Controller	Frame Grabber	Input	Processor
Peritek	www.peritek.com				✓			
PIKA Technologies	www.pikatechnologies.com		✓					
PLDApplications	www.plda.com					✓		
Pulse	www.pulseeng.com	✓						
Red River	www.red-river.com	✓						
RGB Spectrum	www.rgb.com				✓			
SBS Technologies	www.sbs.com				✓			
Sensoray	www.sensoray.com					✓		
Titan	www.titan.com				✓	✓		✓
TriEMS	www.triems.com				✓			
Visiowave	www.visiowave.com					✓		
Voiceboard	www.voiceboard.com	✓						

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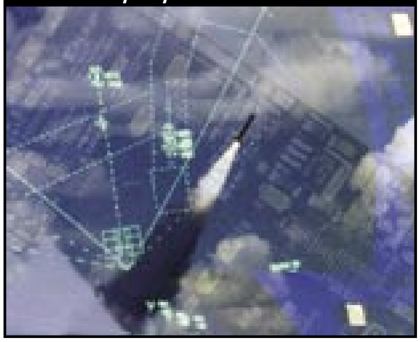
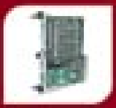
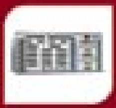
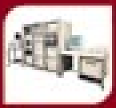
Euresys GrabLink Series

Dy 4 Systems PMC-706



Company Name	Web Site	I/O				Other			
		Analog	Digital	Industrial	Multifunction	Data Acquisition	Digital Multimeters	Digital Radio	Digital-to-Synchro
3-D Engineering	www.3deng.com								
Acqiris	www.acqiris.com		✓			✓			
Acromag	www.acromag.com	✓	✓		✓				
Actis	www.actis-computer.com	✓		✓					
ACTTechnico	www.acttechnico.com	✓							
Adas	www.adas.fr	✓	✓						
ADDI-DATA	www.addi-data.com			✓	✓	✓			
Adlink Technology	www.adlinktech.com	✓		✓	✓	✓			
Agilent	www.agilent.com				✓				
Alacron	www.alacron.com	✓							
Alphi Technology	www.alphitech.com	✓	✓	✓		✓			
AMO	www.amo.de					✓			
Analogic	www.analogic.com	✓	✓			✓			
Ancot	www.ancot.com								
Annapolis Micro Systems	www.annapmicro.com				✓				
Applied Data Systems	www.applieddata.net					✓			
Ascor	www.ascor-inc.com						✓		
Axiom Technology	www.axiomtek.com	✓		✓					
Az-Com	www.az-com.com								
Berkeley Nucleonics	www.berkeleynucleonics.com								
BI RA Systems	www.bira.com	✓							
BittWare	www.bittware.com	✓							
BVM	www.bvmltd.co.uk		✓						
BWI	www.bwi.com	✓		✓					
C&H Technologies	www.chtech.com	✓	✓	✓		✓			
CATC	www.catc.com								
Cluster Labs	www.cluster-labs.com					✓			
Concurrent Technologies	www.gocct.com			✓	✓				
Conduant	www.conduant.com					✓			
Consultronics	www.consultronics.com								
Copeland Communications, Inc.	www.copelandcommunications.com							✓	
CoSystems	www.cosystems.com								

Continued on page 92

Other										
Evaluation Board	LVDT/RVDT	Microwave	Pulse Amplifier	Pulse Generator	Signal Conditioner	Synchro-to-Digital	Test Systems	Waveform Digitizer	Waveform Digitizer/O-scope	Waveform Generator
							✓			
								✓		
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Company Name	Web Site	I/O				Other			
		Analog	Digital	Industrial	Multifunction	Data Acquisition	Digital Multimeters	Digital Radio	Digital-to-Synchro
Creative Electronic Systems	www.ces.ch				✓				
Cyclone Microsystems	www.cyclone.com				✓				
Data Design Corporation	www.datadesigncorp.net		✓						
Data Device	www.ddc-web.com								
Datel	www.datel.com	✓	✓	✓		✓			
DENSAN Systems	www.densan.com		✓						
Digalog Systems	www.digalogpxi.com								
Digilog	www.digilog.com								
Diversified Technology	www.dtims.com				✓				
Domain Technologies	www.domaintec.com					✓			
DRS	www.drs.com	✓							
DSPCon	www.dspcon.com	✓						✓	
D-TACQ Solutions	www.d-tacq.co.uk					✓			
Dy 4	www.dy4.com				✓				
Dynamic Engineering	www.dyneng.com		✓						
Echotek	www.echotek.com		✓					✓	
EKF-Electronik	www.ekf.de				✓				
ELMA Electronic	www.elma.com				✓				
esd	www.esd-electronics.com	✓	✓						
EuroTecH	www.eurotech.it					✓			
EXFO	www.exfo.com								
Extreme Engineering	www.xes-inc.com								
Frequency Devices	www.freqdev.com					✓			
Gage	www.gage-applied.com								
Galil Motion Control	www.galilmc.com			✓					
GE Fanuc Automation	www.gefanuc.com/embedded	✓		✓	✓				
General Standards	www.generalstandards.com	✓	✓	✓	✓	✓			
Geotest	www.geotestinc.com		✓		✓		✓		
GL Communications, Inc.	www.gl.com				✓				
GOEPEL	www.goepel.com					✓			
Highland Technology	www.highlandtechnology.com								
INCAA Computers	www.incaa.com								

Continued on page 94

Other										
Evaluation Board	LVDT/RVDT	Microwave	Pulse Amplifier	Pulse Generator	Signal Conditioner	Synchro-to-Digital	Test Systems	Waveform Digitizer	Waveform Digitizer/O-scope	Waveform Generator
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								✓		
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Company Name	Web Site	I/O: Analog	I/O: Digital	I/O: Industrial	I/O: Multifunction	Other: Data Acquisition	Other: Digital Multimeters	Other: Digital Radio	Other: Digital-to-Synchro
Inducom AcQ	www.acq.nl	✓		✓					
Innovative Integration	www.innovative-dsp.com	✓	✓			✓			
Inova	www.inova-computers.de	✓	✓						
Interactive Circuits & Sys.	www.ics-ltd.com	✓				✓		✓	
Interface Amita	www.interface-co.com		✓						
IO Tech	www.iotech.com			✓					
Joerger Enterprises	www.joergerinc.com	✓							
Kontron	www.kontron.com	✓	✓	✓		✓			
MathWorks	www.mathworks.com					✓			
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Measurement Computing	www.measurementcomputing.com	✓	✓						
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MEN Micro	www.menmicro.com	✓	✓	✓	✓	✓			
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Merlin Electronics	www.merlinelectronics.com	✓							
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Nallatech	www.nallatech.com					✓			
National Instruments	www.ni.com	✓	✓			✓	✓		
National Semiconductor	www.national.com				✓				
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PXIT	www.pxit.com				✓				
Radstone Technology	www.radstone.co.uk	✓	✓						
Reach Technologies	www.reach.bc.ca								
Red River	www.red-river.com							✓	
Rittal	www.rittal.corp.com	✓							
SBS Technologies	www.sbs.com	✓			✓				

Continued on page 96

Other										
Evaluation Board	LVDT/RVDT	Microwave	Pulse Amplifier	Pulse Generator	Signal Conditioner	Synchro-to-Digital	Test Systems	Waveform Digitizer	Waveform Digitizer/O-scope	Waveform Generator
						✓				
										✓
						✓				
					✓			✓		✓
✓										
	✓					✓				
							✓			
							✓			

Company Name	Web Site	I/O				Other			
		Analog	Digital	Industrial	Multifunction	Data Acquisition	Digital Multimeters	Digital Radio	Digital-to-Synchro
Schaffner EMC	www.3.schaffner.com								
Schroff US	www.schroff.us	✓							
Sensoray	www.sensoray.com	✓		✓		✓			
Signametrics	www.signametrics.com						✓		
SMA	www.SMAcomputers.com		✓		✓				
Soltec	www.solteccorp.com			✓	✓				
Sonoran MicroSystems	www.sonoranmicrosystems.com	✓							
Spectrum Sig. Proc.	www.spectrumsignal.com	✓	✓					✓	
Strategic Test	www.strategic-test.com		✓			✓			
Sundance DSP	www.sundance.com	✓	✓			✓		✓	
Systran	www.systran.com	✓		✓					
Technobox	www.technobox.com		✓		✓				
Technology Dynamics	www.technologydynamicsinc.com		✓						
Tecnint	www.tecnint.it					✓			
TEK Microsystems	www.tekmicro.com		✓					✓	
Tenta Technology	www.tenta.com	✓	✓						
Teradyne	www.teradyne.com								
Tews Technologies	www.tews.com	✓	✓						
Thales Computers	www.thalescomputers.com		✓		✓				
Tracewell Systems	www.tracewellsystems.com								
Transtech DSP	www.transtech-dsp.com		✓						
Traquair Data Systems	www.traquair.com	✓							
Tundra Semiconductor	www.tundra.com								
United Electronic Industries	www.ueidaq.com		✓			✓			
Valley Technologies	www.pmcmodules.com					✓		✓	
Vigilant Technologies	www.vigilanttech.com			✓					
VMETRO	www.vmetro.com	✓							
Xycom	www.xycom.com	✓	✓						
Zendex	www.zendex.com				✓				
Zephyr Engineering	www.zpci.com		✓						
ZTEC	www.ztec-inc.com								
Z-World	www.zworld.com					✓			

Other										
Evaluation Board	LVDT/RVDT	Microwave	Pulse Amplifier	Pulse Generator	Signal Conditioner	Synchro-to-Digital	Test Systems	Waveform Digitizer	Waveform Digitizer/O-scope	Waveform Generator
							✓			
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✓										
							✓			
					✓		✓		✓

TEST AND ANALYSIS PRODUCTS

Acromag Inc. AcPC730

AMO GmbH Saturn

National Instruments PXI-6552

GENERAL PRODUCTS

Company Name	Web Site	Prototyping and Debugging					
		Aids	Boundary Scan	Bus Analyzer	Emulator	Fabric Analyzer	JTAG
3-D Engineering	www.3deng.com	✓					
ABS	www.abs-usa.com						
Accelent Systems	www.accelent.com						
Actis	www.actis-computer.com						
ACTTechnico	www.acttechnico.com			✓			
Agilent	www.agilent.com			✓			
Aicas GmbH	www.aicas.com						
AIM USA	www.aim-online.com			✓			
Aisys	www.aisysinc.com						
Alliance Systems	www.alliancesystems.com						
Alphi Technology	www.alphitech.com						
American Logic Machines	www.alm-net.com	✓					
American Megatrends	www.ami.com						
AMO	www.amo.de				✓		
Ancot	www.ancot.com			✓			
APW Electronic Solutions	www.apw.com	✓					
ARC	www.psti.com						
ARM	www.allant.com						
Artesyn Communication	www.artesyncp.com						
Artisan Software Tools	www.artisansw.com						
Az-Com	www.az-com.com	✓					
Aztek Engineering	www.aztek-eng.com						
BittWare	www.bittware.com						
Bloomy Controls	www.bloomy.com						
BSQUARE	www.bsquare.com						
Bustronic	www.bustronic.com	✓					
Carlo Gavazzi	www.gavazzi-mupac.com	✓					
Catalyst Enterprises	www.catalyst-ent.com	✓		✓			
CATC	www.catc.com					✓	
CML Versatel	www.cmlversatel.com						
CMX Systems	www.cmx.com						
CodeGen	www.codegen.com						
Commetrex	www.commetrex.com						
Concurrent Technologies	www.gocct.com						
Continuous Computing	www.ccpu.com						
Corelis	www.corelis.com						✓

Continued on page 100

Other				Software													
Development Platform	IDE	System Integration Services	Technical Reference	Application	BIOS	Board Support Packages	Compilers	Development Tool	Driver	Java	Library	Linux	Modeling Tool	Networking	Operating System	Protocol Stack	Telecom
								✓									
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Company Name	Web Site	Prototyping and Debugging					
		Aids	Boundary Scan	Bus Analyzer	Emulator	Fabric Analyzer	JTAG
CoSystems	www.cosystems.com						
Crystal Group	www.crystalpc.com						
Cyclone Microsystems	www.cyclone.com						
D2 Technologies	www.d2tech.com						
Datalight	www.datalight.com						
Dawn VME Products	www.dawnvme.com	✓					
Domain Technologies	www.domaintec.com				✓		
DSP Research	www.dspr.com				✓		
Dy 4	www.dy4.com						
ELMA Electronic	www.elma.com	✓					
Embedded Technologies	www.embeddedtechnologies.com						
Excalibur Systems	www.mil-1553.com						
Flash Vos	www.flashvos.com						
Force Computers	www.forcecomputers.com						
Frequency Devices	www.freqdev.com	✓					
FuturePlus Systems	www.futureplus.com			✓			
Gage	www.gage-applied.com						
GAO Research	www.gaoresearch.com						
GE Fanuc Automation	www.gefanuc.com/embedded						
General Micro Systems	www.gms4vme.com						
General Software	www.gensw.com						
Geotest	www.geotestinc.com						
GESPAC	www.gespac.ch						
GNP	www.gnp.com						
GoAhead Software	www.goahead.com						
GOEPEL	www.goepel.com		✓				
Green Hills Software	www.ghs.com	✓					✓
Harting	www.harting.com	✓					
HKM	www.pci-tools.com	✓					
Hybricon	www.hybricon.com						
Hyperception	www.hyperception.com	✓					
IBM	www.ibm.com						
I-BUS	www.ibus.com						
Inducom AcQ	www.acq.nl						
Integrated Device Technology	www.idt.com	✓					
Interphase	www.interphase.com						

Continued on page 102

Other				Software													
Development Platform	IDE	System Integration Services	Technical Reference	Application	BIOS	Board Support Packages	Compilers	Development Tool	Driver	Java	Library	Linux	Modeling Tool	Networking	Operating System	Protocol Stack	Telecom
✓																	
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Company Name	Web Site	Prototyping and Debugging					
		Aids	Boundary Scan	Bus Analyzer	Emulator	Fabric Analyzer	JTAG
IO Tech	www.iotech.com						
Jungo	www.jungo.com						
Kaparel	www.kaparel.com			✓			
Kontron	www.kontron.com	✓					
Lantronix	www.lantronix.com						
Lauterbach	www.lauterbach.com				✓		✓
Lucent	www.lucent.com						
LVL7	www.LVL7.com						
LynuxWorks	www.lynuxworks.com	✓					
Lyrtech	www.lyrtech.com	✓					
MathWorks	www.mathworks.com						
MEN Micro	www.menmicro.com	✓					
Mercury Computer Systems	www.mc.com						
Metrowerks	www.metrowerks.com						
Microsoft	www.microsoft.com						
MontaVista	www.mvista.com						
Motorola Computer Group	mcg.motorola.com						
National Instruments	www.ni.com						
ND Tech	www.nd-tech.com						
Neoware Systems	www.neoware.com						
New Wave	www.busboards.com			✓			
NewMonics	www.newmonics.com						
NMS Communications	www.nmscommunications.com						
Numerix	www.numerix.co.uk						
OEM Micro Solutions	www.oemmicro.com						
OSE Systems	www.ose.com	✓					
PCI Embedded Computer Systems	www.pcisystems.com	✓					
PCI Tools	www.pci-tools.com	✓					
Pentek	www.pentek.com						
Performance Technologies	www.pt.com						
PIKA Technologies	www.pikatechnologies.com						
PLDApplications	www.plda.com	✓					
PLX Technology	www.plxtech.com						
ProSyst Software	www.prosyst.com						
QLogic Corp.	www.qlogic.com						
QNX Software Systems	www.qnx.com						

Continued on page 104

Other				Software													
Development Platform	IDE	System Integration Services	Technical Reference	Application	BIOS	Board Support Packages	Compilers	Development Tool	Driver	Java	Library	Linux	Modeling Tool	Networking	Operating System	Protocol Stack	Telecom
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Company Name	Web Site	Prototyping and Debugging					
		Aids	Boundary Scan	Bus Analyzer	Emulator	Fabric Analyzer	JTAG
QuickLogic	www.quicklogic.com	✓					
Radisys (Microware)	www.radisys.com/microware.cfm						
RadiSys Corp	www.radisys.com						
Rittal	www.rittal.corp.com	✓					
SBE	www.sbei.com						
SBS Technologies	www.sbs.com						
Schroff US	www.schroff.us						
Silicon Concepts Ltd.	www.silicon-concepts.com						
Silicon Control	www.silicon-control.com			✓			
Softronics	www.softronix.com				✓		
Spectrum Sig. Proc.	www.spectrumsignal.com						
SSV Software Systems	www.ssv-embedded.de						
StarGen	www.stargen.com						
SynaptiCAD	www.syncad.com						
Synergy Microsystems	www.synergymicro.com						
Systran	www.systran.com						
Technobox	www.technobox.com	✓					
Telelogic	www.telelogic.com						
Texas Instruments	www.ti.com						
Themis Computer	www.themis.com						
TimeSys	www.timesys.com						
Tracewell Systems	www.tracewellsystems.com						
Tundra Semiconductor	www.tundra.com	✓					
Twin Industries	www.twinhunter.com	✓					
VenturCom	www.vci.com	✓					
VMETRO	www.vmetro.com			✓			
Voiceboard	www.voiceboard.com						
Wasabi Systems	www.wasabisystems.com						
Westek	www.westekuk.com						
WIN Enterprises	www.win-ent.com						
Wind River	www.windriver.com	✓			✓		
Xecom	www.xecom.com						
XILINX	www.xilinx.com						
Zephyr Engineering	www.zpci.com	✓					

Other				Software													
Development Platform	IDE	System Integration Services	Technical Reference	Application	BIOS	Board Support Packages	Compilers	Development Tool	Driver	Java	Library	Linux	Modeling Tool	Networking	Operating System	Protocol Stack	Telecom
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Geek approved.

CFO endorsed.

This processor card pops the performance and drops the cost.

In the ongoing struggle between higher performance and lower cost, the clear winner is Motorola's PrPMC family.

Take, for example, the PrPMC815 with a security coprocessor option or the PrPMC800 with AltiVec technology. Both processor PMCs help you increase product performance and lower your total cost of ownership.

That's quite a combination.

So designers and bean counters no longer argue over which card to choose; instead they argue over who identified Motorola's processor PMCs first.

Motorola's family of high performance, flexible processor cards is designed to be the heart of DSP applications in medical equipment, semiconductor production and test equipment, and telecom equipment.

With a complete CPU and memory subsystem, the PrPMC family combined with Motorola's PowerPlus III architecture is the choice of the lab and the CFO to get high end, high performance products to market quickly.

Ethernet capabilities, power efficiency, and a small footprint all meet the demanding needs of the design team and the front office.

For full specs, applications, and availability of the PrPMC family, visit www.motorola.com/computer/arrow03 or call 1-888-427-2250.

Motorola's extensive family of processor PMCs pops your performance and drops your cost. Who says you can't please everyone? These are geek approved and CFO endorsed.

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Your support system™

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Company Name	Web Site	Fieldbus				Other														
		CAN	DeviceNet	Profibus	Other	Alarm	Component-Level Modules	Counter/Timer	GPS/Precision Time Code	Graphics	Image Processing	LVDS	Motion Control	Optical	Servers	System Management	System Monitoring	Touch Interface	Turnkey System	Turnkey System: Telecom
Acromag	www.acromag.com			✓				✓												
ACS-Tech 80	www.acs-tech80.com												✓							
Actis	www.actis-computer.com												✓							
ACTTechnico	www.acttechnico.com					✓													✓	
Adas	www.adas.fr	✓							✓											
ADDI-DATA	www.addi-data.com							✓												
Adlink Technology	www.adlinktech.com	✓								✓			✓		✓					
Advansor	www.advansor.com																		✓	
Advantech	www.advantech.com														✓				✓	
Agilent	www.agilent.com													✓						
Aitech	www.rugged.com									✓										
Alacron	www.alacron.com										✓									
Alliance Systems	www.alliancesystems.com														✓				✓	
AMIRIX Systems	www.amirix.com												✓							
AMREL	www.amrel.com																	✓		
Analog Devices	www.analog.com/dsp													✓						
Ansoft	www.ansoft.com			✓																
Appro	www.appro.com														✓					
Arista	www.aristaipc.com																	✓		
Bloomy Controls	www.bloomy.com																		✓	
Brandywine Communications	www.brandywinecomm.com							✓	✓											
BVM	www.bvmltd.co.uk																		✓	
C&D Technologies	www.cdpoweronline.com						✓													
C&H Technologies	www.chtech.com							✓												
Cambridge Innovations	www.camb-innov.com					✓														
COGNEX	www.cognex.com										✓									
Concurrent Technologies	www.gocct.com									✓										
Continuous Computing	www.ccpu.com																			✓
Coreco Imaging	www.imaging.com										✓									

Continued on page 108

Company Name	Web Site	Fieldbus				Other														
		CAN	DeviceNet	Profibus	Other	Alarm	Component-Level Modules	Counter/Timer	GPS/Precision Time Code	Graphics	Image Processing	LVDS	Motion Control	Optical	Servers	System Management	System Monitoring	Touch Interface	Turnkey System	Turnkey System: Telecom
Creative Electronic Systems	www.ces.ch								✓											
Cybectec	www.cybectec.com																		✓	
Cyberchron	www.cyberchron.com																		✓	
Datel	www.datel.com							✓												
Dawn VME Products	www.dawnvme.com																✓			
Densitron	www.densitron.com																	✓		
Diversified Technology	www.dtims.com																		✓	
DMD Computers	www.dmd.it			✓																
Dy 4	www.dy4.com									✓										
EKF-Electronik	www.ekf.de	✓							✓	✓										
ELMA Electronic	www.elma.com						✓												✓	
Emtrion	www.emtrion.com	✓																		
ERNI	www.erni.com			✓	✓															
esd	www.esd-electronics.com	✓																		
EXFO	www.exfo.com					✓														
Force Computers	www.forcecomputers.com														✓				✓	✓
GE Fanuc Automation	www.gefanuc.com/embedded														✓				✓	
General Micro Systems	www.gms4vme.com									✓										
GESPAC	www.gespac.ch									✓										
GNP	www.gnp.com														✓		✓			✓
HMS Industrial Networks	www.anybus.com				✓															
Hybricon	www.hybricon.com					✓														
I-BUS	www.ibus.com														✓				✓	✓
Inducom AcQ	www.acq.nl	✓						✓					✓							
Inova	www.inova-computers.de	✓		✓	✓					✓									✓	
Intel	www.intel.com																			✓
Interay BV	www.interay.com										✓									
InterlinkBT	www.interlinkbt.com				✓															
ITenclosures	www.itenclosures.com					✓														
ITOX	www.itox.com														✓					

Continued on page 110

Company Name	Web Site	Fieldbus				Other														
		CAN	DeviceNet	Profibus	Other	Alarm	Component-Level Modules	Counter/Timer	GPS/Precision Time Code	Graphics	Image Processing	LVDS	Motion Control	Optical	Servers	System Management	System Monitoring	Touch Interface	Turnkey System	Turnkey System: Telecom
Ixxat	www.ixxatusa.com	✓																		
Janich & Klass	www.janichklass.com				✓															
Janz Computer	www.janzag.de	✓																		
JK microsystems	www.jkmicro.com																		✓	
Kontron	www.kontron.com	✓		✓		✓				✓			✓						✓	
KSI Corporation	www.KSI-corp.com								✓											
Marathon	www.marathon-int.com														✓					
Matrox	www.matrox.com/Imaging									✓										
Media Cybernetics	www.mediacy.com										✓									
MEN Micro	www.menmicro.com	✓		✓				✓	✓	✓			✓							
Mercury Computer Systems	www.mc.com										✓									
Merge Technologies Group	www.mergetech.com																			✓
Micralyne	www.micralyne.com		✓																	
Motion Engineering	www.motioneng.com												✓							
Motorola Computer Group	mcg.motorola.com									✓									✓	✓
National Instruments	www.ni.com	✓	✓					✓					✓							
Neoware Systems	www.neoware.com																		✓	
New Horizons Electronics	www.nuhorizons.com																			✓
NEXCOM International	www.nexcom.com														✓					
NMS Communications	www.nmscommunications.com																		✓	
One Stop Systems	www.onestopsystems.com														✓		✓		✓	
Oregon Micro Systems	www.omsmotion.com												✓							
PCI Embedded	www.pcisystems.com												✓							
Performance Technologies	www.pt.com															✓			✓	
Pericom	www.pericom.com											✓								
Peritek	www.peritek.com									✓										
PFU Systems	www.PFUsystems.com														✓					
Pigeon Point	www.pigeonpoint.com																✓			
Pinnacle Data Systems	www.pinnacle.com														✓					

Continued on page 113

CompactPCI Processor Boards

Whatever your application, we can offer you a choice of high performance CompactPCI® processor boards; these boards are PICMG® 2.16 compliant and support IPMI and many of today's leading operating systems including Windows®, Linux®, VxWorks®, QNX® and Solaris™ Extended temperature products also available

Dual Xeon™

- dual 2.0GHz Xeon processors
- up to 4 Gbytes DDR DRAM
- high performance SCSI and EIDE
- 2 x Gigabit Ethernet interfaces
- PMC site or optional disk drives

PP 220/01x

Dual Pentium® III

- dual 933MHz Pentium III processors
- up to 1 Gbyte DRAM
- high performance SCSI and EIDE
- 4 x Gigabit Ethernet interfaces
- PMC site or optional disk drives

Pentium M (available Q4)

- 1.6GHz Pentium M
- up to 2 Gbytes DDR DRAM
- 3 x Gigabit Ethernet interfaces
- graphics, EIDE, + optional disk drives

PP 120/01x

Pentium 4

- 2.2GHz or 1.7GHz Pentium 4
- up to 2 Gbytes DDR DRAM
- 3 x Gigabit Ethernet interfaces
- high performance SCSI and EIDE
- PMC site or optional disk drives

Pentium III Dual PMC

- 1.2GHz or 800MHz Pentium III 512K
- up to 1.5 Gbytes DRAM
- 2 x Gigabit Ethernet interfaces
- graphics, EIDE and optional disk drives

PP 200/01x

For more information please visit our website, or contact your local office/distributor

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Ann Arbor, MI 48108
U. S. A.
Tel: (734) 971 6309
Fax: (734) 971 6350
http://www.gocct.com

CONCURRENT TECHNOLOGIES

Email: info@gocct.com

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4 Gilberd Court, Newcomen Way
Colchester, Essex CO4 9WN,
U. K.
Tel: (+44) 1206 752626
Fax: (+44) 1206 751116
http://www.cct.co.uk

Company Name	Web Site	Fieldbus				Other														
		CAN	DeviceNet	Profibus	Other	Alarm	Component-Level Modules	Counter/Timer	GPS/Precision Time Code	Graphics	Image Processing	LVDS	Motion Control	Optical	Servers	System Management	System Monitoring	Touch Interface	Turnkey System	Turnkey System: Telecom
Primagraphics	www.primag.co.uk									✓										
Pulse	www.pulseeng.com						✓													
Radstone Technology	www.radstone.co.uk	✓								✓	✓								✓	
RADVision	www.radvision.com																			✓
RGB Spectrum	www.rgb.com									✓										
SBS Technologies	www.sbs.com																✓			✓
Schroff US	www.schroff.us																			✓
Sensoray	www.sensoray.com									✓										
Siemens	www.siemens.com	✓		✓									✓							
SKY Computers	www.skycomputers.com														✓				✓	
SMA	www.SMAcomputers.com				✓															
Soltec	www.solteccorp.com									✓									✓	
Sun Microsystems	www.sun.com														✓					
Symmetricom Inc.	www.symmetricom.com							✓	✓											
Synergy Microsystems	www.synergymicro.com									✓										
Systran	www.systran.com							✓												
Teradyne	www.teradyne.com													✓			✓			
Tews Technologies	www.tews.com	✓																		
Texas Instruments	www.ti.com											✓								
Thales Computers	www.thalescomputers.com									✓										✓
Themis Computer	www.themis.com														✓					
Trilogic Systems	www.trilogicsystems.com					✓														
Tyco Electronics	www.tycoelectronics.com													✓						
Vista Controls	www.vistacontrols.com									✓										
Vitesse Semiconductor	www.vitesse.com													✓						
Voiceboard	www.voiceboard.com																✓			
Wind River	www.windriver.com														✓					
Xycom	www.xycom.com							✓												
Zephyr Engineering	www.zpci.com																		✓	
ZTEC	www.ztec-inc.com							✓												

Company Name	Web Site	Bridge						Memory			
		cPCI-to-cPCI	cPCI-to-PCI	cPCI-to-VMEbus	PCI-to-PCI	PCI-to-VMEbus	Processor-to-PCI	Buffer	Flash	General Purpose	Reflective
Acqiris	www.acqiris.com									✓	
ACTTechnico	www.acttechnico.com										
Aculab	www.aculab.com										
Adas	www.adas.fr										
Agere	www.agere.com										
Alacron	www.alacron.com									✓	
Alpha Data	www.alpha-data.co.uk										
Alphi Technology	www.alphitech.com										
Amtelco	www.amtelco.com										
Applied Precision LLC	www.api.com										
APW Electronic Solutions	www.apw.com	✓									
Aurora Technologies	www.auroratech.com		✓								
BittWare	www.bittware.com										
Chrislin Industries, Inc.	www.chrislin.com									✓	
Cluster Labs	www.cluster-labs.com										
Commetrex	www.commetrex.com										
Communications Automation	www.cacdsp.com										
Computer Modules	www.compumodules.com									✓	
Conduant	www.conduant.com									✓	
Connect One Semiconductors	www.connectone.com										
Coreco Imaging	www.imaging.com										
Creative Electronic Systems	www.ces.ch				✓						
Data I/O	www.dataio.com								✓		
Dataram	www.dataram.com									✓	
Delphi Engineering	www.DelphiEng.com										
DENSAN Systems	www.densan.com				✓					✓	
Domain Technologies	www.domaintec.com										
DRS	www.drs.com										
DSP Research	www.dspr.com										
DSPCon	www.dspcon.com										

Continued on page 116

DSP Resource Boards							Chips & Cores							Other			
CompactPCI	IndustryPack	PC•MIP	PCI/ISA	PMC	Resource Boards	TIM	ARM	Bridging	Bus Interface	DSP	FPGA	MIPS	PowerPC	DSP Algorithm	DSP Alternative	FPGA	PCMCIA
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Company Name	Web Site	Bridge						Memory			
		cPCI-to-cPCI	cPCI-to-PCI	cPCI-to-VMEbus	PCI-to-PCI	PCI-to-VMEbus	Processor-to-PCI	Buffer	Flash	General Purpose	Reflective
Dy 4	www.dy4.com				✓						
Dynamic Engineering	www.dyneng.com										
EKF-Electronik	www.ekf.de										
Eonic Systems	www.eonic.com										
Eureka Technolgoy, Inc.	www.eurekatech.com				✓		✓		✓		
Extreme Engineering	www.xes-inc.com		✓								
Fairchild	www.fairchildsemi.com										
GAO Research	www.gaoresearch.com										
GE Fanuc Automation	www.gefanuc.com/embedded									✓	✓
General Standards	www.generalstandards.com				✓				✓		
Graychip	www.graychip.com										
Hartmann Elektronik	www.hartmann-elektronik.de		✓								
Hewlett Packard	www.cpus.hp.com										
Hunt Engineering	www.hunteng.co.uk										
Inducom AcQ	www.acq.nl								✓		
Infineon	www.infineon.com										
Innovative Integration	www.innovative-dsp.com										
Inova	www.inova-computers.de								✓	✓	
Kaparel	www.kaparel.com				✓						
LSI Logic	www.lsilogic.com										
Mango DSP	www.mangodsp.com										
Mellanox	www.mellanox.com				✓						
MEN Micro	www.menmicro.com									✓	
Mercury Computer Systems	www.mc.com									✓	
Micro Memory	www.umem.com									✓	
MIPS Technologies	www.mips.com										
Motion Engineering	www.motioneng.com									✓	
Motorola Computer Group	mcg.motorola.com										
Nallatech	www.nallatech.com										
National Instruments	www.ni.com		✓								

Continued on page 118

DSP Resource Boards							Chips & Cores							Other			
CompactPCI	IndustryPack	PC•MIP	PCI/ISA	PMC	Resource Boards	TIM	ARM	Bridging	Bus Interface	DSP	FPGA	MIPS	PowerPC	DSP Algorithm	DSP Alternative	FPGA	PCMCIA
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Company Name	Web Site	Bridge						Memory			
		cPCI-to-cPCI	cPCI-to-PCI	cPCI-to-VMEbus	PCI-to-PCI	PCI-to-VMEbus	Processor-to-PCI	Buffer	Flash	General Purpose	Reflective
New Horizons Electronics	www.nuhorizons.com										
NMS Communications	www.nmscommunications.com										
North Atlantic Industries	www.naii.com										
Nova Engineering	www.nova-eng.com										
Octasic	www.octasic.com										
Odin TeleSystems	www.OdinTS.com										
Orion Technologies	www.otisolutions.com										✓
Pericom	www.pericom.com				✓						
Peritek	www.peritek.com		✓								
PLDApplications	www.plda.com										
PLX Technology	www.plxtech.com				✓						
Polycom	www.polycom.com										
QuickLogic	www.quicklogic.com				✓					✓	
Radstone Technology	www.radstone.co.uk								✓		
Real-Time Digital	www.rtdsp.com										
Reasearch Center	www.module.ru										
RF Engines Limited	www.rfengines.com										
Sanmina-SCI	www.sanmina.com									✓	
SBS Technologies	www.sbs.com			✓							
Sensoray	www.sensoray.com		✓								
Signalogic	www.signalogic.com										
Signatec	www.signatec.com										
SimpleTech	www.simpletech.com								✓		
SMA	www.SMAcomputers.com										
Smart Modular Tech.	www.smartm.com									✓	
Solflower Computer	www.solflower.com			✓							
Spectrum Sig. Proc.	www.spectrumsignal.com										
StarCore	www.starcore-dsp.com										
StarGen	www.stargen.com				✓						
Sundance DSP	www.sundance.com										

Continued on page 120

DSP Resource Boards							Chips & Cores							Other			
CompactPCI	IndustryPack	PC•MIP	PCI/ISA	PMC	Resource Boards	TIM	ARM	Bridging	Bus Interface	DSP	FPGA	MIPS	PowerPC	DSP Algorithm	DSP Alternative	FPGA	PCMCIA
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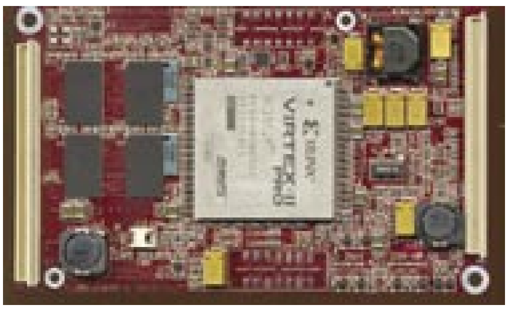
Company Name	Web Site	Bridge: cPCI-to-cPCI	Bridge: cPCI-to-PCI	Bridge: cPCI-to-VMEbus	Bridge: PCI-to-PCI	Bridge: PCI-to-VMEbus	Bridge: Processor-to-PCI	Memory: Buffer	Memory: Flash	Memory: General Purpose	Memory: Reflective
Synergy Microsystems	www.synergymicro.com									✓	
Systran	www.systran.com									✓	
Targa Systems	www.targasystems.com								✓		
Technobox	www.technobox.com				✓				✓		
Texas Instruments	www.ti.com				✓						
Texas Memory Systems	www.texmemsys.com										
Tracewell Systems	www.tracewellsystems.com	✓									
Transtech DSP	www.transtech-dsp.com										
Traquair Data Systems	www.traquair.com										
Tundra Semiconductor	www.tundra.com					✓	✓				
Twin Industries	www.twinhunter.com		✓								
Ubicon	www.ubicom.com										
Valley Technologies	www.pmcmodules.com										
Virtium Technology	www.virtium.com							✓		✓	
Vitesse Semiconductor	www.vitesse.com										
Voiceboard	www.voiceboard.com										
XILINX	www.xilinx.com										

BOARD LEVEL PRODUCTS

Valley Technologies, Inc. VT-142x

Sundance SMT338



GENERAL PRODUCTS

DSP Resource Boards							Chips & Cores							Other			
CompactPCI	IndustryPack	PC•MIP	PCI/ISA	PMC	Resource Boards	TIM	ARM	Bridging	Bus Interface	DSP	FPGA	MIPS	PowerPC	DSP Algorithm	DSP Alternative	FPGA	PCMCIA
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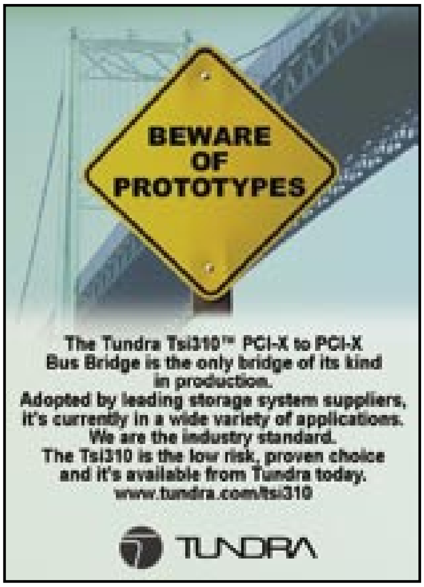
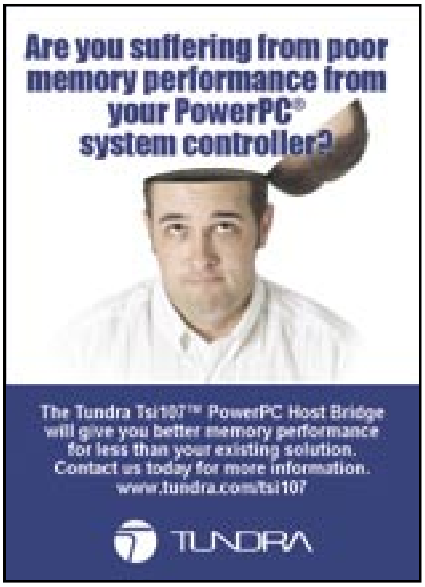




NEW PRODUCTS

By Eli Shapiro E-mail: newproducts@opensystems-publishing.com

CompactPCI

BACKPLANE: SWITCHED FABRIC

Performance Technologies

Web site: www.pt.com
Model: CPC440X **RSC No:** 16668
A 10/100/1000 Ethernet switching platform • CompactPCI packet switching backplane-compliant • 24 10/100 auto-negotiating Ethernet ports • Two Gigabit ports • Rugged, hot-swap CompactPCI 6U form factor • PICMG 2.16-compliant • 802.3ad link aggregation, VRRP, 802.1q VLANs, and 802.1q CoS • Can be configured as a fully redundant, non-blocking switching fabric

BRIDGE: PCI-TO-PCI

PLX Technology

Web site: www.plxtech.com
Model: HB1 **RSC No:** 16388
A low-cost PCI-to-PCI bridge chip • PCI Local Bus specification rev 2.1 • CompactPCI Hot Swap compliant • Small footprint 128-pin package • Supports 3.3V, 32-bit, 33 MHz operation • Synchronous primary and secondary ports • Arbitration support for four bus masters on secondary interface

DATA ACQUISITION

National Instruments

Web site: www.ni.com
Model: PXI-4220 **RSC No:** 16771
A PXI data acquisition board for high-speed strain measurements • Two strain gauge inputs at 200 Ksamples/sec, 16-bit resolution • Programmable excitation (0V-10V) per channel • Programmable gain (1 to 1000) per channel • Programmable 4-pole Butterworth filter (10 Hz, 100 Hz, 1 KHz, 10 KHz) per channel • Quarter, half, and full-bridge completion • Differential simultaneous sampling inputs • Dual 9-pin D-Sub connectors (one per channel) • Two shunt calibration circuits per channel • Remote sensing • NI-DAQ driver simplifies configuration and measurements • Compatible operating systems: Windows 2000/NT/XP • Includes NI-DAQ 7 driver software

DATACOM: SERIAL CONTROLLER

VISTA Controls Corporation

Web site: www.vistacontrols.com
Model: PSC8/SPMC **RSC No:** 16994
Serial I/O PMC • Eight Channels of Serial communications: Four RS-423 and four RS-422/485 • 8 Kbytes D/P Buffer Memory • 32 Kbytes EEPROM • DMA engine to decrease CPU loading (RS-422) • Supports Bit and Byte Protocols • Data rates to 38.4 Kbaud/sec over RS-423 • Data rates to 4 Mbits/sec over RS-422 • Supports asynchronous formats • HDLC and SDLC protocols and CRC generation • User-configurable data size, stop bits, parity and baud rate generator • Local loop-back and auto-echo modes • PMC interface • Air Cooled and Conduction Cooled versions are available • BIT (Built-in-Test)

DSP RESOURCE BOARDS: COMPACTPCI

SMA Computers

Web site: www.SMAcomputers.com
Model: CDSP **RSC No:** 16502
A 3U CompactPCI DSP board • TI TMS320C6202 DSP at 300 MHz • 16 Mbytes of RAM • 1 Mbyte of Flash EPROM • Two 32-bit timers • Four 12-bit analog inputs • Two RS-422 serial ports • 24-bit line camera interface

ENCLOSURE + CARD RACK + POWER SUPPLY

Hybricon Corp.

Web site: www.hybricon.com
Model: RME21 Enclosures **RSC No:** 16208
A line of CoolSlot enclosures for CPCI PICMG 2.16, VME, and VME64x • 19 rackmount enclosures, 10U high, 21 Deep • CompactPCI PICMG 2.16, VME64x and VME backplanes available • Pac-2000 IEEE 1101.10/11 card cage • Front panel power switch (DC enable) • Reset switch • Handles • Optional peripheral mounting for three standard 5.25" peripherals

One Stop Systems Inc.

Web site: www.onestopsystems.com
Model: OSS-ENCL-6U-14-600 **RSC No:** 17003
8U high enclosure, gold chem filled aluminum (optionally painted to customer's specification) • 14-slot CompactPCI backplane with H.110 telephony bus (optional backplanes available) • Up to four 3U, hot-swap, 200W power supplies • Three hot-swap fans (53cfm each) and three hot-swap blowers (23cfm each) • Optional hard drive canisters • Optional Internet-based system monitor • TUV/UL agency approvals

GRAPHICS

VISTA Controls Corporation

Web site: www.vistacontrols.com
Model: Duros/PMC **RSC No:** 16047
Conduction cooled • High-resolution • Dual head display controller • Features Silicon Motion's 128-bit SM731 graphics accelerator • Dual VGA or VGA+DVI outputs • 2D/3D displays running on VxWorks or Linux • Supports DirectX and 3D/OpenGL when running Windows • 32-bit PCI bus, DMA controller • 235 MHz RAMDAC

I/O: DIGITAL

General Standards Corporation

Web site: www.generalstandards.com
Model: cPCI-HPDI32A **RSC No:** 16617
A bi-directional, 32-bit digital I/O board that transmits and receives data at up to 80 Mbytes/sec (differential I/O) or up to 200 Mbytes/sec (Pseudo ECL I/O) • Useful as a general-purpose DMA interface to a variety of external peripherals • The DMA engine is capable of transferring data to/from host memory using D32 block transfers, while the FIFO memory (up to 1 Mbyte of total FIFO) provides continuous transmission of data without interrupting the DMA transfers or requiring intervention from the host CPU • Seven bi-directional programmable handshake lines and eight pre-configured software selectable interface protocols • Available transceivers are RS-485/422 and PECL • Available in CompactPCI, PMC, PCI, and PC/104-Plus form factors

MIL-STD-1553

Western Avionics Ltd

Web site: www.western-av.com
Model: IIB-1553-PMC **RSC No:** 16880
An intelligent interface card providing full MIL-STD-1553 test, simulation and bus analysis capability for the PCI Mezzanine standard, with 1553A, 1553B, McAir, and STANAG 3838 variants • Supports concurrent Bus Controller (BC) and up to 31 Remote Terminals (RT) with Bus Monitor (BM) • An additional stand-alone Chronological Bus Monitor (CBM) facility is also provided, with comprehensive, multi-level triggering capability • Full error injection capability is provided in BC and RT modes, with full error detection in BC, RT, BM, and CBM modes • Provides a dual redundant 1553 interface • 2 Mbytes of dual-ported RAM • Supplied with C drivers in source code and Windows menu driven software

PROTOTYPING & DEBUGGING: BUS ANALYZER

FuturePlus Systems Corporation

Web site: www.futureplus.com
Model: FS2232 **RSC No:** 16384
An analysis tool for SCSI bus developers • Works in conjunction with Agilent Technology's family of logic analyzers • Allows monitoring of SCSI-based systems at 80 Mtransfers/sec • Displays SCSI bus activity, measures setup and hold violations, characterizes software, verifies compliance, and measures performance specifications

SERVERS

Pinnacle Data Systems, Inc.

Web site: www.pinnacle.com
Model: TS220 **RSC No:** 16998
A NEBS Level 3 and ETSI certified carrier grade rack server • 2U high • Utilizes up to two Xeon 2.80 GHz processors • Supports up to 12 Gbytes of DDR SDRAM main memory • Supports pluggable storage devices • Configurable for either AC or DC hot-swap power • Dry-contact external connector for managing system alarms

SOFTWARE: DEVELOPMENT TOOL

National Instruments

Web site: www.ni.com
Model: TestStand **RSC No:** 16762
A ready-to-run test management environment for organizing, controlling, and executing automated prototype, validation, and manufacturing test systems • Graphical sequence editor environment • Adapters for tests written in any programming language • Multithreaded sequence execution engine • ASCII, HTML/Web, and XML report generation • Access, Oracle, and SQL Server database connectivity • Create, edit, execute, and debug sequences • More than 30 built-in step types to choose from • Develop custom test steps for unique requirements • Advanced sequencing, branching, and flow control • Source code control system integration

THERMAL MANAGEMENT

Universal Air Filter Co.

Web site: www.uaf.com
Model: Broadband Dual EMI Filters
RSC No: 16507
Broadband equipment air filters • Meets the EMI/RFI noise shielding requirements of broadband communications equipment utilizing forced-air cooling techniques • Provides air filtration and EMI shielding in a single, compact assembly that is both removable and low cost • Integrates the honeycomb and/or stainless steel mesh EMI shield into the air filter assembly • Filter frames are configurable with EMI gaskets, finger stock, conductive caulk, and mounting holes for positive grounding • Compliant with UL 94 HF-1, UL 900 Class 2, CE, Telcordia NEBS GR-78-CORE, and GR-63-CORE • Optionally configurable to comply with the flame-drip requirements in UL 60950

VIDEO: DISPLAY CONTROLLER

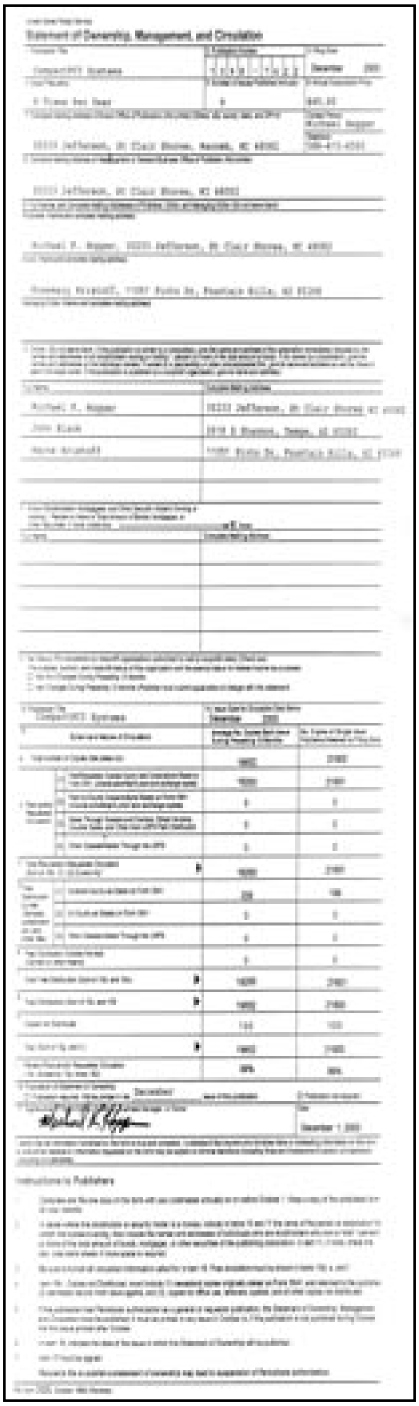
Peritek Corporation

Web site: www.peritek.com
Model: Duros/PMC **RSC No:** 16514
A ruggedized, high-resolution COTS VGA graphics controller • Silicon Motion SM731 128-bit, 2D/3D graphics controller • Resolution up to 1600 x 1200 • Onboard 32-bit, 33/66 MHz PCI interface • Dual-head analog VGA output • DVI output (optional: single channel) • Pixel size is programmable for 8, 16, 24, and 32 bits/pixel • 16 Mbytes of SDRAM graphics memory • Hardware scroll, pan, and cursor • Field-programmable VGA BIOS EEPROM • Conduction cooled • Acrylic conformal coating • Parts screened for extended temperature • Interlaced and non-interlaced STANAG 3350 A-C analog video standards • Composite and S-Video in PAL, NTSC, or SECAM • Non-interlaced RGB signals • Monochrome video in CCIR or RS-170 format • PCI and CompactPCI using Peritek's PM-Series of carrier boards • Microsoft Windows 2000/XP support • X Windows support (Linux) • SDL Standard Drawing Library (VxWorks) • OpenGL support (Windows only)

VIDEO: PROCESSOR

Titan Corporation

Web site: www.titan.com
Model: VigraWATCH **RSC No:** 16511
An all-digital solution for real-time video/image acquisition, processing, and display • Integrates hardware accelerated processing with MPEG-2 compression • Provides MPEG-2 compression and/or decompression for the transmission of high-resolution digital video over lower bandwidths • Supports stereo audio input/output and MPEG-2 audio compression and/or decompression • Available as doublewide PMC mezzanine and 10.5" long PCI form factors • Supports the Solaris operating system • 2.5 Gbytes/sec video processing bandwidth • Utilizes a dense, high-speed FPGA combined with a IBM 440 PowerPC processor for real-time image processing and robust performance for MPEG-2 compression and decompression • MPEG-2 codecs support stereo audio as well as two vide channels • Supports two separate graphics displays, each with an independent video window in the display • Simultaneously displays real-time video with non-destructive graphics overlay to a window • Drives two SVGA monitors as scalable, de-interlaced video-only displays • 24-bit accelerated graphics up to 1600x1200 resolution on both displays • Onboard fully duplexed 10/100Base-T Ethernet • 16 Mbytes per channel of graphics memory and 24 Mbytes per channel of video memory • Interfaces to variety of standard and non-standard video cameras and other image sources


Statement of Ownership, Management, and Circulation

CompactPCI Systems

Michael F. Hopper, 30233 Jefferson, St. Clair Shores, MI 48082

Instructions to Publishers

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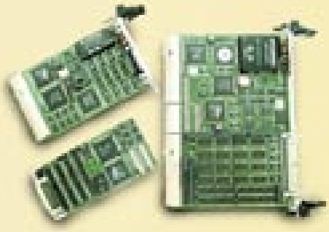
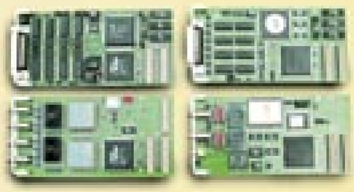
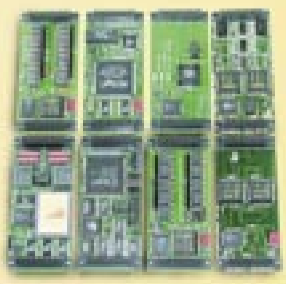
MIL-STD-1553
- UTMC Summit
- DDC ACE & mini ACE
- 1,2,3,4 channels
- Dual redundant
- For: CompactPCI, PMC, PCI & Industry Pack



Analog I/O
- 16 bit A/D and D/A
- Fast S/H converters
- DSPs and waveform RAM
- Simultaneous sampling
- For: CompactPCI, PMC, PCI, VME & Industry Pack

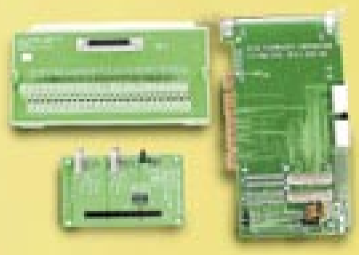


PMC Modules
- Data Acquisition
- Mil-Std-1553
- DSP & FPGA
- D/A out w/ wave RAM
- Communications



Industry Packs
- Data Acquisition
- Mil-Std-1553
- FPGA
- D/A out w/ wave RAM
- Serial I/O, Networking
- Digital, Isolated I/O

Industry Pack Carriers
- For: CompactPCI, PXI PCI and VME bus
- 3U & 6U form factor
- Front and rear I/O
- Low cost slave versions
- High performance with local DSP processors



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... it's a complete system approach
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The neutral promotor of CompactPCI technology
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RSC#	Advertiser/Product Description
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3702	ACTTechnico – Embedded Storage
87	Adax – Signaling Gateways
20	Advantech – 6U CompactPCI Low Power Intel Pentium-M Processor Board VGA/Dual Giga LANs/PMC
124	Alphi Technology – Integrated Systems
27	Amtelco XDS – Multi-Chassis Interconnect Boards
206	APW Electronic Solutions – Switched Fabrics
106	Arrow – PrPMC
4501	Aurora Technologies – StarFabric Board and System Level Products
2	Bivar – cPCI Guides with Conductive Insert Eliminate Grounding Problems. Ideal for RFI, EMI and EMC Installations
66	Bustronic – Switched Fabric Backplanes
9101	California PC Products – CompactPCI Chassis
203	Carlo Gavazzi – Systems Packaging, Fabric and I/O Connectivity
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3701	CES International – PowerPC Processor
3101	Comtrol – 16-port CompactPCI Serial Card
112	Concurrent Technologies – CompactPCI Processor Boards
1701	Condor Engineering – Mil-Std-1553
1703	Condor Engineering – ARINC
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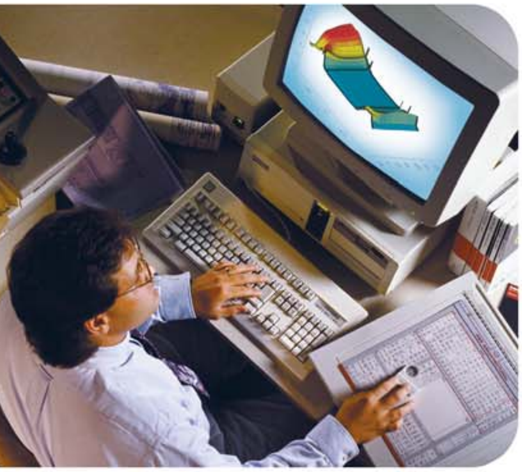

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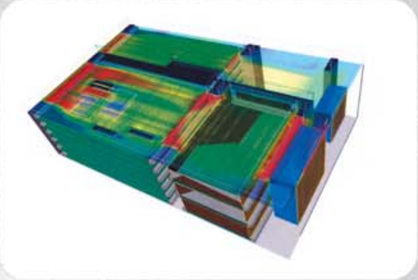

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